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DEPARTMENT OF AGRICULTURE

# QUEENSLAND AGRICULTURAL JOURNAL

Carting Kikuyu Grass on a Buck-rake to an Ensilage Stack.

## LEADING FEATURES

Tobacco Growing in Mareeba-Dimbulah
The Avocado
Circular Pig Farrowing Pen
Seed Processing
Fleece Measurement
Glassers Disease
Are Egg-laying Competitions Outmoded?

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

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**(A list of extension services in southern Queensland will appear in our next issue.)**

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# Tuberculosis-Free Cattle Herds.

## TESTED HERDS (As at 20th December, 1955).

The Tuberculosis-free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements. The studs listed here have fulfilled the conditions to the date shown above.

| Breed. | Owner's Name and Address. |
|---|---|
| Aberdeen Angus .. | The Scottish Australian Company Ltd., Texas Station, Texas |
| A.I.S. .. .. .. | M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy |
| | F. B. Sullivan, "Fermanagh," Pittsworth |
| | D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth |
| | W. Henschell, "Yarranvale," Yarranlea |
| | Con. O'Sullivan, "Navillus" Stud, Greenmount |
| | H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest |
| | J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy |
| | Sullivan Bros., "Valera" Stud, Pittsworth |
| | Reushle Bros., "Reubydale" Stud, Ravensbourne |
| | H. F. Marquardt, "Chelmer" Stud, Wondai |
| | A. C. and C. R. Marquardt, "Cedar Valley," Wondai |
| | A. H. Sokoll, "Sunny Crest" Stud, Wondai |
| | W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt |
| | G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar |
| | C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman |
| | W. H. Thompson, "Alfa Vale," Nanango |
| | S. R. Moore, Sunnyside, West Wooroolin |
| | H.M. State Farm, Numinbah |
| | D. G. Neale, "Groveley," Greenmount |
| | Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy |
| | A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah |
| | W. D. Davis, "Wamba" Stud, Chinchilla |
| | Queensland Agricultural High School and College, Lawes |
| | C. K. Roche, Freestone, Warwick |
| | Mrs. K. Henry, Greenmount |
| | D. B. Green, Deloraine Stud, Durong, Proston |
| | E. Evans, Wootha, Maleny |
| | T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla |
| | J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora |
| | M. F. Power, "Barfield," Kapaldo |
| | A. H. Webster, "Millievale," Derrymore |
| | W. H. Sanderson, "Sunlit Farm," Mulgildie |
| Ayrshire .. .. | L. Holmes, "Benbecula," Yarranlea |
| | J. N. Scott, "Auchen Eden," Camp Mountain |
| | "St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane |
| | E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny |
| | C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough |
| | G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie |
| | T. F. Dunn, Alanbank, Gleneagle |
| Friesian .. .. | C. H. Naumann, "Yarrabine" Stud, Yarraman |
| | D. J. Pender, "Camelot," Lytton road, Lindum |
| Guernsey .. .. | C. D. Holmes, "Springview," Yarraman |
| | A. B. Fletcher, Cossart Vale, Boonah |
| | W. H. Doss, Degilbo, *via* Biggenden |
| | A. C. Swendson, Coolabunia, Box 26, Kingaroy |
| | C. Scott, "Coralgrae," Din Din road, Nanango |
| | R. J. Wissemann, "Robnea," Headington Hill, Clifton |
| | G. L. Johnson, "Old Cannindah," Monto |
| Jersey .. .. .. | Queensland Agricultural High School and College, Lawes |
| | J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount |
| | J. F. Lau, "Rosallen" Jersey Stud, Goombungee |
| | G. Harley, Hopewell, M.S. 189, Kingaroy |
| | Toowoomba Mental Hospital, Willowburn |
| | Farm Home for Boys, Westbrook |
| | F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line |
| | R. J. Browne, Hill 60, Yangan |
| | P. J. L. Bygrave, "The Craigan Farm," Aspley |
| | R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy |
| | P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood |
| | E. A. Matthews, "Yarradale," Yarraman |
| | A. L. Semgreen, "Tecoma," Coolabunia |
| | L. E. Meier, "Ardath" Stud, Boonah |
| | A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk |
| | W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood |
| | Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango |
| | F. W. Verrall, "Coleburn," Walloon |
| | C. Beckingham, Trouts road, Everton Park |
| | W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala |
| | G. H. Ralph, "Ryecombe," Ravensbourne |
| | Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy |
| | W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah |
| | Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman |
| | D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick |
| | J. W. Carpenter, Flagstone Creek, Helidon |
| | H. G. Johnson, "Windsor" Jersey Stud, Beaudesert |
| | W. S. Kirby, Tinana, Maryborough |
| | S. A. Cramb, "Trecarne Stud," Lockyer |
| | G. & V. Beattie, "Beauvern," Antigua, Maryborough |
| | J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla |
| | W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah |
| Poll Hereford .. | W. Maller, "Boreview," Pickanjinnie |
| | J. H. Anderson, "Inverary," Yandilla |
| | D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick |
| | E. W. G. McCamley, Eulogie Park, Dululu |
| | Wilson and McDouall, Calliope Station, Calliope |

# Brucellosis-Tested Swine Herds (As at 20th December, 1955)

## Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington" Stud, Underwood road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
N. F. Cooper, Maidenwell
R. H. Coller, Tallegalla, *via* Rosewood
E. J. Clarke, "Kaloon" Stud, Templin
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
W. F. Ruhle, "Felbrie" Stud, Kalbar
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan Road, Greenslopes
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, *via* Rosewood
J. B. Lotz, M.S. 794, Kalbar
G. J. Hutton, Woodford
E. R. Kimber, Coalstoun Lakes
K. B. Jones, "Cefn" Stud, Pilton
A. J. Potter, "Woodlands," Inglewood
Regional Experiment Station, Hermitage
L. Pick, Mulgeldie
J. W. Bukowski, "Secreto" Stud, Oxley

## Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
G. J. Hutton, Woodford
H. L. Larsen, "Oakway," Kingaroy
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
Kruger and Sons, "Greyhurst," Goombungee
V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri
L. C. and C. P. F. Hill, Kingaroy

## Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
L. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood
P. V. Campbell, "Lawn Hill," Lamington
L. C. and C. P. F. Hill, Kingaroy

## Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
F. K. Wright, Narangba, N. C. Line
R. A. Collings, "Rutholme" Stud, Waterford
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
A. J. Hicks, M.S. 98, Darlington, *via* Beaudesert
Kruger and Sons, "Greyhurst," Goombungee

## British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

## A MESSAGE FROM THE MINISTER.

The land industries are to be congratulated on the success of their efforts to increase production in 1955. In the face of floods, cyclones and other hazards of life on the land, primary producers registered a very creditable performance in all fields of endeavour.

Perhaps one of the most notable features of the year, so far as my Department is concerned, was the further cementing of the association between the Department and producers' organisations.

For some time past the Department and producers have been coming closer together with the object of sorting out production and marketing problems and applying themselves to their solution. Last year saw the formation of a new type of joint committee—the District Dairy Extension Advisory Committee. The primary function of these district committees is to speed the adoption of recommended farming practices.

Each district committee is comprised of progressive local farmers and district officers of the Department. Its advice is freely available to any dairy farmer who seeks it. The successful operation of these committees would point the way to further progress in dairying and other forms of farming.

I extend my very best wishes to all primary producers and their wives and families for a rewarding year in 1956.

H. H. Collins

Minister for Agriculture and Stock.

# Tobacco Growing in the Mareeba—Dimbulah Area.

By E. W. BAIRD, Senior Adviser in Agriculture.

(*Continued from page 320 of the December issue.*)

## CROP MATURITY.

When the crop has been grown under irrigation and rainfall variations are eliminated, the time taken for a crop to reach maturity is 12-14 weeks from planting out. After the first harvest has been made the ripening of the leaf is affected considerably by temperature variations, overcast conditions, &c., but it is usually completed in 6–8 weeks. This gives a total period of approximately 24-28 weeks from the sowing of the seed to the completion of harvesting.

When the crop is grown under rainfall conditions the time to maturity is controlled by the season itself. If a favourable season is received the period would closely approximate that given above. If, however, great variations in rain incidence, temperatures and cloudiness are encountered, growth and ripening may be considerably delayed.

## PRIMING.

Priming consists of removing the bottom leaves from the plant when it has attained a height of about 12-18 in. It is considered that leaves which have become badly damaged by coming in contact with the ground are worthless. Their removal allows better circulation of air around the plant and this operation is of value in rain-grown crops where certain fungus diseases may be temporarily kept in check.

Under irrigation, it is of value to remove bottom leaves which have become damaged by various causes, in order to maintain a high level of quality in the resultant crop. Where the bottom leaves are not damaged in any way, they form a valuable part of the plant and usually command a good price.

## TOPPING AND SUCKERING.

Topping consists of removing the flowering head from the plant. It has the action of diverting plant foods from the formation of seed to the leaves. When this is done the plant attempts to fulfil its natural function of reproduction by producing suckers from the leaf axils. If left, these suckers will flower and produce seed,

thus robbing the crop of any advantages derived from topping.

Topping is usually done high—that is, the head is broken off immediately above the highest leaf which is deemed to be of commercial value when fully grown. Low topping has the effect of producing leaves which are heavy in texture, dark, of poor quality, and which exhibit a reluctance to ripen. If it becomes apparent that topping has been too high, plants can be topped a second time; but if topped too low much damage will result even though the top suckers are left to remove some of the body from the leaf. The time to top is when a fair percentage of the field has come in flower. It should, however, not be delayed too long, as this may have an adverse effect on the quality of the leaf.

Suckers should not be allowed to grow more than two inches in length, at which stage they can be easily removed. If left to grow coarse they are difficult to break and damage to the leaf may result. Suckering is a tedious, constant and expensive job but one which must not be neglected.

Experiments are now in train to test the efficiency of chemical control of suckers. Applications of certain mineral oils have been made during the topping operation, their function being to run down the stems and actually prevent the growth of the suckers. While experiments have shown that such treatments are effective in certain circumstances, further testing is necessary before the method can be recommended for general use.

Plate 16.

**An Irrigated Tobacco Crop Approaching Maturity.** This crop, which was well-grown and showed only slight insect damage, was estimated to yield 1,500–1,800 lb. of cured leaf per acre.

Plate 17.

**Irrigated Tobacco Leaf Approaching Maturity, Mareeba District.**

## HARVESTING.

In order to obtain the best results from the crop and produce good even cures of the brightest possible leaf, great care and attention must be given to this operation.

Leaf ripens from the base of the plant upwards, and only ripe, mature leaf should be taken at each harvest. When leaf is ready for harvest, several changes occur in the leaf and definite symptoms are apparent. In fine leaf, the colour changes from a green to a lighter green or yellowish green. In heavier bodied, crinkly leaf, yellowish spots appear on the leaf. These areas must be very pronounced before the latter type of leaf is ripe.

The tip of the leaf will ripen first and when this is yellow or creamy coloured the leaf is mature and ready for harvest. Another indication sometimes used is when the midrib on the back of the leaf has turned from green to white.

Ripe leaf is snapped from the plant and placed across the arm, care being taken not to tear or bruise either the harvested leaf or the surrounding leaves. When an armful has been obtained, it is carried to the end of the row, placed on a "stretcher" with the butts towards the outside and covered by bag or hessian. Covering the leaf is important, as the hot rays of the sun will readily scorch exposed leaf. When the stretcher is full it is placed on a wagon and transported, with others, to the stringing shed.

A stretcher is made by placing two cornsacks together end to end, and inserting bush poles or sawn timber through them to form a carrier. The best time to harvest leaf is from early morning, as soon as sufficient light

enables colours to be distinguished, till noon. Harvesting during the heat of the day should be avoided if possible.

If prolonged hot weather occurs and irrigation is delayed, a premature yellowing of the leaves may occur. This is termed "false ripening" and when it occurs harvesting should be deferred. The procedure is to irrigate, after which the leaf will return to a green colour. Later it will ripen normally, when harvesting can proceed. If "false ripened" leaf is harvested, it will cure green and will be considerably lowered in value.

Harvesting during long periods of wet and cloudy weather should be avoided if possible, as thin, black trashy leaf usually results. With the return of sunshine, cures will revert to normal.

The number of picks necessary to complete the harvest is dependent on weather conditions during the time of harvest. In a normal crop it would take from 8 to 12 such picks to complete the harvest.

Yields which could reasonably be expected range from 500 lb. of cured leaf per acre from rain-grown crops to 1,000-1,200 lb. per acre from irrigated crops.

## STRINGING.

After the leaf is brought into the stringing shed, it is removed from the stretchers and placed on benches with the butts pointing outwards. It is strung on 1 in. square sticks which are sufficient in length to fit the tier-poles in the barn being used. The operator places the stick on a stand called a "horse" and attaches the string to one end of the stick; the ball of string is conveniently located on a peg at the rear of the stand.

The leaves are taken from the bench, generally in twos or threes, and hung from the stick by taking a turn around the butts with the string and at the same time giving the leaves a half-turn to tighten them against the stick. This is repeated on alternate sides of the stick. The number of ties on a stick varies with the size of the leaf

Plate 18.

**Stringing the Harvested Leaf on Sticks for Placing in the Curing Barn.** Note the alternate arrangement of the leaves on either side of the stick.

but it is not advisable to crowd on too much leaf. It has been found that operators working singly can fill a barn quicker than if working in pairs.

After stringing, the sticks are placed on the tierpoles in the barn, which should be nicely full. Over-crowding should be avoided, as curing difficulties may result. It is advisable to fill the barn in the one day if possible or uneven cures may be obtained.

## CURING.

It is not possible to lay down hard and fast rules regarding curing, but the process is designed to produce the best possible results from the leaf available. It must be realised that several factors may combine to vary the standard curing process.

As experience is gained in this most important phase of the production of cured tobacco, better cures should result. Some conditions with which the operator will have to cope are wet weather, sudden variations in temperature and humidity, and variations due to plant position, leaf texture, picking efficiency, &c.

There are three stages in curing tobacco:—(1) colouring the leaf (2) fixing the colour; and (3) drying out the midrib. During the first stage the leaf changes from its colour when picked to a yellow or light pea-green colour. The fixing process is designed to eliminate all green from the leaf, fix the colour desired and partly dry the leaf. The third stage completes the drying-out process, particularly of the midrib.

### Curing Kilns.

The curing process universally adopted in North Queensland is the

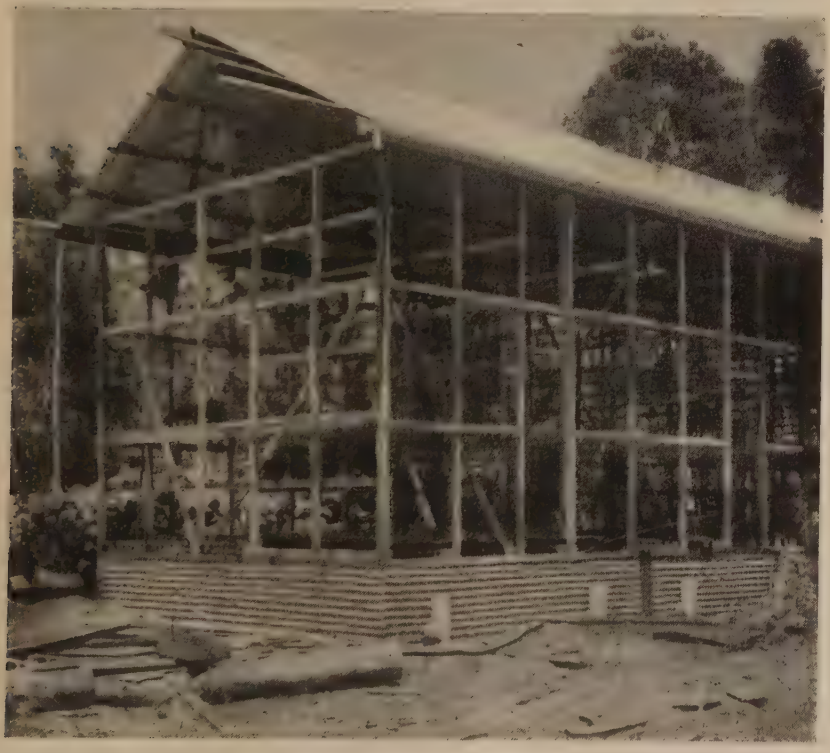

Plate 19.

**Tobacco Curing Kilns under Construction.** This series is of timber frame and corrugated iron construction. A stack of firewood is held in reserve.

flue-curing process (or modifications thereof) designed to produce leaf of a colour, aroma and texture suitable for cigarette tobacco manufacture. This process is carried out in curing kilns, or as they are popularly called, "barns."

In order to produce the best quality tobacco, it is necessary to be able to control effectively the temperature and humidity within the barn. The structure should, therefore, be made of material which ensures the best possible insulation from outside influences and from adjoining barns.

this, it is suggested that, for a field of 12 acres, sufficient space would be provided by 3 barns each 12 ft. x 12 ft. x 7 tiers, together with one barn 16 ft. x 16 ft. x 7 tiers. The distance between the tierpoles is usually about 2 ft. 6 in.

The heating device used has been a series of iron, brick or cement flues so placed that heat radiating from their surfaces warms the barn evenly throughout its capacity. The flues also carry the smoke and gases from the firebox to the atmosphere without liberating them within the barn.

Plate 20.

**Transporting Experimental Batches of Leaf to the Barn for Curing.** This picture, taken on a former Tobacco Experiment Farm, shows one type of galvanized iron barn.

The size of the barn is determined by the acreage to be harvested, but it has been found that on average sized farms 12 ft. x 12 ft. barns are adequate if one 16 ft. x 16 ft. barn is available to cope with a sudden ripening of the crop caused by any unforeseen seasonal influence. The ideal is to have sufficient barn space available to accommodate all leaf as it ripens naturally in the field. To do

The old standard method of providing heat to the flues is by means of an exterior furnace or fire-box. In some forms of construction a deep-set trench is used, capable of burning long and irregular lengths of bush timber. Other forms use an above-ground fire-box, suitable for use with short lengths of wood and other forms of solid fuel.

A most recent advance in the direction of heat production has been successful use of kerosene and dieseline fuel instead of wood. This system has many advantages, some of which are as follows:—

(1) A more even heat is established throughout the barn, causing better cures.

(2) Less attention need be given to curing and more can be devoted to necessary field work.

(3) A drop in temperature sufficient to upset curing does not occur if the barn is left unattended for long periods.

(4) The necessity for attending a barn at night is eliminated.

(5) The onerous job of cutting cord-wood is eliminated.

The above advantages in the use of liquid fuel systems are somewhat offset by the extra cost of curing. Under most conditions, however, it is considered that the advantages far outweigh this disadvantage.

Barn construction in the past has been dictated by the relative availability and cost of materials at the time of erection. The chief materials which have been used in the Mareeba-Dimbulah district are brick, concrete brick, and wooden frame. The last-mentioned may have iron or fibro-cement on the outside and insulating material on the inside.

An efficient barn consists of a concrete foundation, housing the heating appliance, with the above-ground structure having a wooden frame with fibro-cement walls on the outside and caneite or similar insulating material on the inside. The structure is ceiled and has a roof, the ends of which are made so as to prevent the wind blowing directly through it. Barns should be ventilated with both top and bottom vents, to enable accurate control of air, both outward and inward, to be obtained. Full details of barn construction may be obtained from the Department of Agriculture and Stock.

The capacity of barns varies with the floor dimensions and the number of tiers. A standard 12 ft. by 12 ft. curing barn having 7 tiers will hold 350-400 sticks with comfort, whilst the larger 16 ft. by 16 ft. barn of similar height will hold 700-800 sticks. Far more sticks than the numbers indicated could be pushed into the barn, but overloading is a very bad practice, which could be detrimental to the cure.

## Curing Details.

The details of the curing process are as follows:—

90°F.-100°F.—Close all vents and if necessary light a small fire in the firebox. Hold at this temperature till the leaf is pea-green or three-quarters yellow. When this stage is reached the top vents are opened to one-quarter and the bottom to one-eighth of their capacity. Raise the temperature to 105°F.

105°F.—Hold at this temperature from 3 to 5 hours till the tips are firm to the touch. Change vents—top to half-open and bottom to quarter-open.

110°F.—Take temperature gradually up to 110°F. and hold till the leaf curls up at the ends. Open top vent to three-quarters-open and the bottom to half-open.

115°F.—Take temperature gradually at 1° per hour to 115°F. and hold till the edges of the leaf curl inwards. Leaf may be held at this temperature till all the remaining green has left. Open top vent full open and the bottom vent three-quarters-open.

120°F.—Advance to this temperature at 1° per hour and hold till the web of the leaf is dry. Reduce top vents to half-open and the bottom to quarter-open.

130°F.—Advance temperature 2° per hour till 130° is reached and hold at this temperature till the veins are dry. Leave the vents as before.

140°F.—Raise temperature 5° per hour till this temperature is reached. Reduce top vent to one-eighth-open and the bottom to quarter-open.

160°F.—Raise temperature at the rate of 5° per hour and hold till the midrib is perfectly dry and brittle.

When absolutely sure that no undried midribs are present, the fire is drawn and the barn allowed to cool down.

### Points in Curing.

The following points are given for guidance:—

(1) Do not allow the temperature to rise quickly during the colouring process, as sponging or scalding may occur.

(2) For good even cures the leaf must be of uniform ripeness. Good picking is essential.

(3) Do not overload barns or sponging will result.

(4) Fast curing is poor curing.

(5) Be sure the flues are fitting tightly and are in good order, to avoid fires.

(6) Do not allow leaf which has fallen to remain on the flues or on the tops of kerosene or oil burning equipment.

(7) Inspect your barn for air-leaks, as these will cause uneven cures.

(8) In wet weather, increase top ventilation and decrease bottom ventilation.

(9) In cold or windy weather, less ventilation is needed, particularly on the windy side.

(10) Do not unnecessarily open the door of the barn.

(11) Do not allow "runback" by a drop in temperature when the web of the leaf is drying out.

(12) If the leaf is sponging, increase ventilation and temperature. When the excess moisture has gone, return to the proper temperature and ventilation and proceed normally.

Before the barn can be unloaded the leaf must be brought to the condition in which it can be handled. To do this, moist air must be allowed into the barn and sufficient is usually obtained by opening all vents and the door to the night air. In the morning the leaf should be pliable enough to be handled without breaking.

If the night air is not sufficient to condition the leaf satisfactorily, steam must be introduced into the barn or the leaf removed to conditioning racks and held till a satisfactory condition is obtained. It is most important that the leaf should not be overconditioned. This would cause mould to form in the bulks and render the leaf worthless. It must be remembered that undue exposure to light and frequent moisture fluctuations will reduce the colour of the leaf with resultant loss of value.

## BULKING.

Bulking means packing the cured leaf, after removal from the sticks, into organised stacks about 3 ft. wide and as long and high as convenient. It is first necessary to prepare a base on which to stack the leaf. This is done by placing material such as 3 in. x 2 in. timber on the floor and placing three-ply or similar material on top. This raises the stack from the floor, allowing ventilation around it. The ends of the stack are usually made from boards or plywood extending from the floor to the ceiling and secured at each end by cleats.

The leaf must be in proper condition for bulking—that is, it must be pliable enough without being too moist. If it is too dry there is a danger of breaking the leaf, and if it is too moist it will lose colour and have a tendency to heat and develop mould. On no

Plate 21.

**Removal of the Leaf from the Barn after Curing.** The next process is to take the leaf from the sticks and bulk it down.

account should midribs which have not been completely dried out during curing be bulked. These are termed "fatty stems" and will surely cause mould.

It is important that the bulkshed be lined and ceiled to avoid moisture fluctuations. Light should be kept out by covering the windows with blinds, hessian or bag.

It is important that due regard be given to the position of the leaf on the plant, and bulks should be made from the same type of leaf only. Leaf can be classified as "lugs," "cutters," "leaf" and "tips", and each type should be bulked separately. If it is necessary to place them together in the same bulk, a partition of paper should indicate the division between the types so placed. This separation will facilitate grading at a later date.

It is advisable to leave the bulk in place for about 4-6 weeks, if possible, before grading. During this time it is advisable to turn the bulks at least once in order that they may be inspected for possible damage from mould, insect pests, etc.

When building the bulk, leaves are placed in two rows with the butts facing outwards, with a third layer between and overlapping each in order to bind them together. When the stack is considered high enough it should be covered and weighted. This has the effect of pressing the bulk together and eliminating any greencast or light green colour which may not have been removed during curing. Fixed green colour will not be removed by bulking.

## PREPARATION FOR MARKET.

### Grading.

Grading is carried out either on the farm or at a central grading shed. In each instance it takes the form of sorting out the various types of leaf according to plant position, colour, quality, size, and damage.

If the bulking of tobacco has been carried out correctly (that is, according to plant position), grading is greatly facilitated. Details of grading on the basis of plant position have been published in the *Queensland Agricultural Journal* for September, 1955, and are readily available from the Department of Agriculture and Stock.

Grading is carried out on grading tables which have upon them a series of spaces or small compartments, each of which is used to hold a separate grade. The number of grades which will be made depends upon the season under which the crop was grown and the crop itself.

It is not advisable to make too many grades. Usually 17 to 20 will be ample, but at the same time care must be taken to separate adequately each distinct type of leaf. Failure to do this will result in a mixed offering which will be low in value and unattractive to buyers.

The colour grades are Lemon, Bright Mahogany, Mahogany, Dark, and Green. Within these colour grades after plant position has been established, leaf is sorted as to quality, soundness and size.

Green leaf is sorted to light green or dark green. It is preferable to rebulk the light green type of leaf till all grading is finished, as the green may have a tendency to "bulk" out. It can then be re-sorted. The dark or fixed green leaf should be destroyed.

It must be stressed that it is impossible to lay down simple directions for grading, as each crop is different. However, with experience, the various types of leaf are readily recognised and can be separated quickly and well. If the crop has not been bulked according to plant position there are leaf characteristics which, although not infallible, are a good guide to such position.

### Baling.

After grading, each grade is tied into hands and stored ready for baling. Bins are constructed around the walls of the bulkshed to accommodate each grade of leaf. It is very important that grades are not mixed within the hands or in the bale. If this is done, not only is the object of grading defeated but the action may even debar the offering from sale.

When forming into hands, leaf of the same grade is taken and placed together in such a way that the butts will measure 1–1¼ in. in diameter. A leaf of the same grade is tightly wound around the butt at the end, extending about 2 in. down the stems. The leaves are then parted in the middle and the stem of the binding leaf passed between.

Hands should be tied firmly and present a neat appearance. A common fault is to make the hands too big. These have a tendency to fall apart when samples are pulled from the bale for inspection by buyers.

Finished bales should have the following measurements:—3 ft. long, 2 ft. high and 2 ft. wide. This size facilitates handling and setting up on the appraisal floor. The construction of a baling press and the method used in baling can be ascertained by referring to Advisory Leaflet No. 174.

## MARKETING.

The marketing of leaf in Queensland is handled by the Tobacco Leaf Marketing Board. Acting as broker for the Board in North Queensland is the North Queensland Tobacco Growers' Co-operative Association Ltd., which has display floors in Mareeba and Townsville. The display floors are set up by arranging crops according to grade, lot numbers being given to each bale and catalogues compiled accordingly.

Sale dates are allocated to the districts by the Tobacco Leaf Marketing Board after conferring with the manufacturers. Prior to the sale, manufacturers' representatives inspect all leaf, affix their prices on their own catalogues, and bid from these on auction day.

Plate 22.

**Tobacco Leaf on Display at a Selling Floor.** Bales have been opened up and hands of leaf removed, for inspection by buyers.

## ADMINISTRATION.

Tobacco is grown subject to the provisions of the *Tobacco Industry Protection Act of* 1933. It is the duty of all growers, including share-farmers, to register with the Department of Agriculture and Stock prior to August of the season during which the crop is grown. Cards for this purpose may be obtained from local Advisory Officers or direct from the Department of Agriculture and Stock, William street, Brisbane. It is also necessary for all farmers to be registered with the Customs Department under *The Excise Acts.*

Neither of these registrations involves the payment of a fee. Failure to comply with these regulations renders the offender liable to a heavy fine.

## PESTS AND DISEASES.

The main pests which are likely to be encountered in the field are the leaf miner, stem borer, loopers, budworm and cluster caterpillar.

All of these except the looper may be controlled by DDT sprays, whilst the looper may be satisfactorily checked by the addition of endrin or dieldrin to the spray schedule.

Insect attack is markedly influenced by the prevailing weather conditions, and in consequence it is essential to have sufficient insecticides and equipment on hand at the commencement of the season to cope with any outbreak which would otherwise reduce the yield and value of the crop.

The most important diseases encountered are blue mould, mosaic and Cercospora leaf spot. Blue mould is normally likely to be the most destructive disease if it gains a hold in the field. While there are not at present available any direct means of field control, cultural operations can assist in reducing its incidence. The mosaic virus may also be an important cause of losses in yield and quality. As it can be transmitted by touch, field hygiene is of great importance in keeping it under control.

Departmental leaflets are available giving up-to-date information on pest and disease control. These leaflets are readily obtainable from your local district office or from the Department's Head Office in Brisbane.

# The Principles of Seed Processing.

By R. J. B. LINNETT, Inspector, Standards Branch.

The cleaning and conditioning of seed is an important step in the production of a high quality commodity which is to be used for planting purposes. It is not enough to merely harvest the seed.

Threshing or winnowing may suffice to clean the seed only under the most favourable circumstances, and as these are rarely met, some serious attempt at separating all foreign and extraneous matter must be undertaken if a high quality product is to be produced.

The farmer of today is becoming more quality conscious and is demanding better seed, and in consequence more and more efficient seed processing machines are being installed in Queensland produce premises.

Seed processing involves the removal of material foreign to the seed type being handled. Depending on the condition and cleanliness of the seed the treatment may be simple or complex: it may involve anything from a single simple operation to a complex sequence utilising several types of equipment. It is desirable to produce a top quality product free from weed seeds, and having high purity and germination and bright uniform appearance.

The Agricultural Standards (Seeds) Regulations provide standards of analytical purity and germination for most seeds sold in Queensland. These standards should be taken as minimum requirements and not as a goal for the final product. Seed produced under the Queensland Certification Scheme must conform to even higher standards of analytical purity and germination.

Final analysis figures should preferably be considerably higher than those laid down under the Regulations and this is particularly important as far as germination is concerned to ensure good keeping qualities. This applies particularly to carry-over seed.

To achieve maximum efficiency in seed processing, much thought has gone into the design of equipment. It is now possible to fulfil almost all requirements for the cleaning, grading and dressing of any type of seed. Approximately 54 seed processing machines are located in 18 Queensland towns, being fairly well distributed throughout the seed producing areas.

The term "seed processing" covers the three major uses to which seed machinery is put—cleaning, grading and dressing (dusting or pickling).

## CLEANING.

Cleaning involves the removal from the seed of all extraneous matter such as weed seeds, sticks, straw, stones, dirt, insects, seed glumes (hulls) and trash generally. Theoretically, all of this matter should be removed, leaving pure seed only. However, no machine is 100% efficient and a very small proportion of impurities can always be expected in the product.

This factor was taken into consideration when standards for purity, set down in the Seed Regulations under the Agricultural Standards Act, were drawn up, and it is not difficult to better these figures by using an efficient machine handled by an operator who understands his equipment.

## GRADING.

When extraneous matter has been removed, the next step is to grade the seed. Grading is necessary when the bulk contains a proportion of dead seed, or when under-sized or over-sized grains are required to be separated in order to produce a uniform product.

The only sure way of determining the amount of dead seed present is to have a preliminary germination test carried out to find the potential

"growing ability" of the seed. This will indicate the percentage of seed that should be removed. The grader may be set accordingly. Unfortunately, this test usually involves a delay which cannot always be afforded and so it is usual to carry out partial grading at the time of cleaning.

In the case of a poor batch of seed that contains obviously dead and shrivelled grains, an examination of a sample of the seed will indicate that grading is necessary.

## DRESSING (DUSTING OR PICKLING).

Finally, it is sometimes necessary to dress or dust the seed. This involves coating each grain with a chemical dressing. If the seed is to be stored for some time before being planted, a dressing to prevent insect infestation would be desirable. To prevent fungal growth and the spread of seed-borne diseases, a fungicidal dressing would be advantageous. Sometimes the application of more than one dressing is desired—for example, a dressing to prevent fungal growth followed by the application of an insect repellant. This multiple dressing can be achieved either by using two or more separate machines or by using a mixed dressing.

These three major operations are not necessarily performed separately; they may be combined. The processing becomes more economical when the individual treatments are combined.

## CLEANING AND GRADING PRINCIPLES.

Seed processing equipment is scientifically designed and is built to make use of natural phenomena associated with different seed types. Some of these are listed below:

(1) Difference in physical shape.
(2) Difference in specific gravity.
(3) Reflection or transmission of light.
(4) Flotation.
(5) Centrifugal force.
(6) Magnetic force.
(7) Elasticity.

Sometimes machines are built making use of one of these principles only, but usually two or more are involved with emphasis on one of them.

### (1) Shape.

Generally, machines in this category make use of oscillating screens, rotating screens, indented cylinders, pocketed discs, roll machines and ring cylinders.

A variation of this method may be applied when certain seeds are present in the sample. Some seeds (for example *Salvia reflexa*—mintweed) are surrounded by a coat which becomes sticky with the addition of water. If a sample containing these seeds is introduced into wet sawdust, the wood particles will soon cling to the mucilaginous coat, thus effectively increasing the size of the coated seeds while leaving the others unaffected. It is then a simple matter to screen off the enlarged grains.

Minute differences in physical shape, not immediately apparent upon a casual glance, may nevertheless be used for the separation of seeds. Close inspection reveals that some seeds (for example, *Cuscuta* sp.—dodder) have rough coats while others have smooth coats (for example, lucerne), and in cases such as these the roll machine is used. The rollers are covered with special material which will pick up the rough seeds, leaving the smooth grains to pass through. The ring cylinder is another variation: it consists of a series of precision ground rings spaced at various set distances apart so that different shaped and sized seeds fall through different spacings, thus giving various grades. The remaining machines are described later.

### (2) Specific Gravity.

The denseness of material constituting the seed may be used to separate seeds regardless of size or shape. Equipment making use of this principle includes some vibratory and most air blast types, both pressure and suction. The latter are sometimes known as "air float" machines. Water has also been used as a separating medium, but the need for thorough drying of the seed is a distinct disadvantage.

### (3) Reflection or Transmission of Light.

The ability of the seed or seed coat to reflect or transmit light at varying intensities is made to actuate the sorting or grading machinery of photo-electric or "magic eye" graders.

### (4) Flotation.

This involves the separation of seeds by—

(*a*) Transferring the mixed seed to a liquid of suitable specific gravity in order to float one type of seed and sink the other. (This method could be listed under Specific Gravity.)

(*b*) Transferrring the mixed seed to a suitable liquid and allowing the differences in surface tension of the liquid surrounding the seeds of different types to either float or sink them—that is, some seeds are more "wettable" than others.

The seed has to be thoroughly dried immediately after treatment of this kind.

### (5) Centrifugal Force.

This may be explained as the tendency of an object possessing circular motion to leave the curved path and continue in a straight line. This force and that of specific gravity have been used in the design of a machine consisting in its simplest form of a vertical spiral chute narrow at the top (input) and widening towards the bottom, and terminating in two or more chutes at the outlet. As the seed spirals down the chute, centrifugal force causes the heavier seed to be deposited in the outside chute and the lightest in the inside chute.

### (6) Magnetic Force.

This has been used for seed separation. It involves coating the seed with a magnetic substance such as iron dust or magnetite. Different seeds retain different amounts of the magnetic coating and the more heavily coated grains are removed by an electro-magnet. Discolouring of the seed is a problem.

### (7) Elasticity.

Another phenomenon that has been used for seed separation is that of elasticity. Some seeds are more elastic than others—that is, some types will bounce further than others, and the more resilient seeds can be made to travel further than others, thus making a separation.

Not all of these types of machines will be found in Queensland and they are mentioned as a matter of general interest only. In this State, the following types will be found in use:—

*Group* 1: (*a*) Oscillating screen; (*b*) rotating screen; (*c*) pocketed discs; (*d*) indented cylinders.

*Group* 2: Specific gravity or air float.

## DRESSING.

In Queensland only the "dry pickling" process is employed, although wet or slurry treating is practised elsewhere.

The principle most commonly used here in dressing of seed involves tumbling the grain and chemical dressing together in a rotating cylinder of suitable design. The grains are thus coated at a rate determined by the

setting of the dust flow control. The most successful feeder for supplying the dressing at a pre-determined rate is the electric vibrator. The dressing falls from a hopper onto a small table oscillating at a rate set by the turn of a knob. The dressing flows over the end of the table to the cylinder in a continuous uniform stream.

## AUXILIARY EQUIPMENT.

The following auxiliary machines are closely associated with seed processing but are not essential to actual cleaning.

### Clipping.

The clipping machine is used for cutting the long ends from such glumed seeds as oats. This is usually accomplished by blades rotated at a high speed inside a perforated stator cylinder.

### Polishing.

The polishing machine is used for removing soil and discolouration from seeds such as beans. The action is obtained by agitating the seed with sawdust or other polishing mediums.

### Peg Drum.

The peg drum consists of a cylinder in which are mounted collapsible fingers which beat seedheads when revolved at high speed, thus breaking up seed clusters.

### Dust and Air Purification.

An important point that must be considered is the removal of dust from the atmosphere where equipment is installed, particularly where the dust emanates from dry picklers dusting with organic mercury and other harmful dusts. The installation of a system consisting of exhaust fans feeding into cyclone or organ pipe precipitators is effective, collecting dust-laden air from above hoppers and picklers, separating the solid content and discharging clean air to the atmosphere. If this cannot be effectively removed, protective clothing and respirators should be worn to prevent the ill effects which may be caused by some dusts when used in quantity. Queensland's summer climate at times makes their use uncomfortable and operators are then reluctant to wear them freely.

## GENERAL.

With any machine, whether on the farm or in the merchant's shed, several points must be observed to obtain maximum efficiency.

Probably the most important single factor is to be certain that the machine is thoroughly cleaned before processing is commenced. In most cases this means partial dismantling of the machine and a thorough going over with brush, vacuum cleaner or blower. Every possible place where residual grains from the previous batch may lodge must be inspected and cleaned to ensure that contamination of the seed during processing is remote.

Before selecting screens the operator must know what is to be removed from the seed. This is determined by a rough purity analysis.

Care must be exercised in selecting the screens, and setting controls in order to take out foreign matter without wasting seed. Screens must be selected by a trial hand sieving and this should be carried out carefully in order to obtain the finest separation possible with the range of screens available. A trial run on a few bags should be carried out to confirm this.

While cleaning is in progress, check samples should be taken from the product frequently and examined to be sure the standard is maintained.

The machine's capacity must not be exceeded. That is, do not feed the machine more seed than it can efficiently handle.

One cleaner will not necessarily perform all jobs and sometimes two or more types are required to make a difficult separation.

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(An article on seed processing equipment in use in Queensland will appear in an early issue of the Journal.)

**Beef Cattle on Poona Pea and Green Panic at Boonah.**

**Cobs of Hybrid Maize Drying Out in a Beaudesert Barn.**
This crop is in process of being certified.

# The Avocado.

By R. L. PREST (Senior Adviser in Horticulture) and A. A. ROSS (Horticulturist).

The avocado (*Persea gratissima*, fam. *Lauraceae*) is a native of Central America and the West Indies. The trees (Plate 1) are usually evergreen but some varieties drop many of their leaves and become almost bare during the blossoming period. The habit of growth is variable, some types being tall and unbranched while others are short and spreading. Under favourable conditions, the tree may reach a height of over 60 feet with a spread of 35 feet. Grafted trees are usually slightly dwarfed and tend to spread.

The fruit varies in size and may be round, pyriform (pear-like) or oval in shape (Plate 2). The external skin colour ranges from yellowish-green through dark-green, maroon, brown, reddish-brown to purplish-black, and the skin may be membranous, tough, leathery, brittle or woody. The fruit contains a single large seed, surrounded by flesh which is yellow to greenish in colour and has the consistency of butter.

In Queensland, the area under crop is still small (about 60 acres) but planting is proceeding as rapidly as grafted trees become available. At present practically all the orchards are in the south-eastern portion of the State.

## CLIMATIC AND SOIL REQUIREMENTS.

The avocado will not tolerate extremes of temperature, but the Mexican race is somewhat resistant to frost and can survive temperatures of 20°-24°F. for short periods. The Guatemalan varieties are less resistant to frost than the Mexican but the West Indian varieties can only be expected to do well in frost-free areas.

Plate 1.

**The Avocado Tree.** Variety Nabal, eight years old.

Weather conditions at blossoming largely determine the size of crop produced, for excessive rain in this period reduces the amount of effective pollination. Cold weather or low atmospheric humidity also upsets pollination by reducing the receptivity of the stigmas in the flowers.

Hot, dry winds can be disastrous to the avocado crop, for they disturb the water relationships of the tree and cause shedding of the blossoms or young fruit. Strong winds of any kind are responsible for surface blemishes on the fruit.

Plate 2.
**Clusters of Fruit.** Left, Anaheim; right, Nabal.

The avocado is extremely susceptible to poor drainage. When selecting a site for an orchard, therefore, every effort should be made to locate a soil type without a clay band, hard pan or any other formation in the subsoil which may impede the free flow of water through the soil. Usually 3 feet of top soil is required for the orchard and this may vary in texture from a sandy loam to a clay loam. Heavy clay loams are undesirable because of their natural association with poor drainage.

As with all other orchard crops, tree growth is most vigorous on soils which are well supplied with organic matter and possess an open structure.

## VARIETIES.

The numerous varieties of the avocado are grouped into three horticultural races, namely Guatemalan, West Indian and Mexican. The first two are somewhat alike in external characters but the Guatemalan fruit normally ripens during winter and spring and has a woody skin $\frac{1}{16}$ to $\frac{1}{4}$ in. thick, while the West Indian fruit ripens in summer and autumn and has a leathery skin not more than $\frac{1}{16}$ in. thick. The Mexican race is quite distinct, having a pronounced anise odour in

the leaves when crushed, a shiny under-surface on the leaves, relatively hairy flowers and comparatively small fruit with a thin membranous skin; its fruit usually ripens in early winter.

Many seedling orchards exist in all parts of the world and hybridisation between the three horticultural races has occurred. Fuerte, the chief commercial variety in California, is considered to be a hybrid from Mexican and Guatemalan parents.

In the course of the commercial production of avocadoes, numerous varieties have been developed and further improvements can be expected. At present Fuerte, Nabal, Anaheim and Hass are considered the best.

### Fuerte.

A hybrid variety which exhibits characters of both the Mexican and Guatemalan races. The tree is hardy and somewhat prone to biennial bearing. Blossoming takes place during early July and August and the fruit matures during the following April and May.

The fruit is pear-shaped, varies in size from 6 to 16 oz. and the relatively thin, dull-green skin separates readily from the flesh. The flesh is a creamy-yellow, merging into green near the skin, and has a very rich flavour, a smooth buttery texture and an oil content of 18-22%. The seed is of medium size and tight in the cavity.

### Nabal.

A variety of the Guatemalan type with a vigorous, well-branched symmetrical tree. It is more subject to alternate bearing than Fuerte, and in the "on" year the crop may be extremely heavy. Blossoming takes place in late October and November and the fruit matures about 12 months later.

The fruit (Plate 2) is almost spherical and weighs from 14 to 30 oz. The skin is smooth, dark-green in colour, thick and granular in texture. The flesh is creamy-yellow but green near the skin, and has an oil content of 18-22%. The flavour is exceptionally good and the texture smooth. The seed is comparatively small and held tight in the cavity.

Plate 3.

**Fruit Types.** Note the variability in shape and skin texture. Varieties are (from left to right) Anaheim, Edranol, Hellen, Hazzard, Ryan and Graham.

### Anaheim.

A variety of the Guatemalan type with a tall upright tree which is rather susceptible to frost and therefore best suited to coastal areas. It is a prolific bearer but the fruit quality is inferior to that of Fuerte and Nabal and the fruit is readily damaged by wind. Blossoming occurs in September to October and the fruit matures in the following July to August. The fruit (Plates 2 and 3) is ovoid, weighs 12 to 28 oz., and has a rough, glossy-green skin of medium thickness.

### Hass.

A Guatamalan-type avocado which has been grown only to a limited extent in Queensland. The tree has an upright habit of growth and requires training in the orchard. It is not specific in its climatic requirements and might do well in sub-coastal areas.

The fruit matures between November and January. It is pear-shaped to ovoid, 6-12 oz. in weight, and has a tough and leathery skin which is green when harvested but gradually turns black as the fruit ripens. The flesh contains 18-22% of oil and is of good flavour and quality. The greatest defect of this variety is the black skin colour at maturity.

### Other Varieties.

Minor varieties which have been grown in Queensland with some measure of success are Ryan, Edranol, Benik, Queen, and Puebla.

## PROPAGATION AND PLANTING.

Vegetative propagation of the avocado is a standard practice in nurseries. Various methods have been used, but the best results are obtained from tip grafts and a modified bark-graft using young succulent scion wood with either one or two buds (Plate 4).

Seeds of the rootstock variety are planted with the apex at soil level in specially prepared beds which should be kept continually moist but not over-wet. The seedlings are later transferred to nursery rows spaced 3 feet apart with 14-18 inches between the seedlings.

Little information is available on the suitability of the various rootstocks for Queensland conditions, but in California preference is given to Mexican strains, mainly because of their reputation for frost resistance. Guatemalan stocks are also compatible with most scions and produce vigorous trees. However, vigour may not be particularly important in commercial practice, for small trees have many advantages in a commercial orchard.

Nursery trees are usually transplanted into the orchard during February, when the natural rainfall maintains the soil moisture at levels which are favourable for rapid establishment. However, spring planting may be practised if the trees can be irrigated regularly. Avocado roots are extremely sensitive to drying and when the trees are balled for despatch, care should be taken to avoid damage to the fibrous roots. If the trees leave the nursery bare-rooted, the root system should be lightly covered with moist sphagnum moss and wrapped in a plastic cover.

When planting the tree the union should be kept above ground level and as far as possible with the graft on the southern side to escape sunburn. It is usual to protect the trunk from the sun with paper or some other type of wrap, particularly if the trees are planted in the spring. Immediately after planting, a basin should be formed round each tree and filled with water; further irrigations at frequent intervals are required until all are firmly established. In the immediate vicinity of the tree, weeds are kept in check by shallow cultivation.

Plate 4.

**Grafted Avocado Tree in the Nursery.** Commercial varieties are usually propagated on Mexican stocks. The stub of the seedling is temporarily retained as a tie support for the scion and will be removed later. This tree will be transplanted within three months.

Avocado trees grow very large and a minimum permanent spacing of 35 feet is required. Under favourable conditions, it may be worth while to double-plant in one direction to increase the acre-yield in the young orchard. Alternate trees can be removed when crowding becomes obvious.

## PRUNING.

The avocado tree requires little or no pruning once the frame has been established. In general, the aim is to establish a strong symmetrical tree having well-spaced branches which can support heavy crops of fruit.

At planting, the young tree should be headed back just above the strongest of the dormant buds near the growing point; these buds usually make upright growth. Subsequent pruning consists of pinching out terminal buds and the removal of crossing and unwanted branches. The kind and amount of pruning differs with varieties; trees such as Fuerte, with a straggling and spreading habit, are pruned to force growth upwards. On the other hand, tall-growing varieties such as Anaheim are cut to buds pointing outwards to preserve low heads. As the trees grow older, the lower limbs are shortened and finally removed to make room for the upper branches which bear down towards the ground.

## SOIL MANAGEMENT.

Cultivation in an avocado orchard is practically the same as that in a citrus orchard. Weeds should be controlled by shallow cultivation in order to conserve soil moisture but deep working should be avoided at all times. The organic matter content of the soil should be built up with dressings of farmyard manure or by growing green manure crops.

In Queensland, the fertilizer mixtures used in citrus are suitable for avocadoes but the rates of application are less. An 8/10/8 mixture can be applied in late winter or early spring at the rate of $\frac{1}{2}$ lb. per tree per year of age with a maximum of 8 lb. A late February dressing of a complete mixture with a 10/8/7·5 or similar formula at the rate of $\frac{1}{3}$ lb. per tree per year of age, with a maximum of 6 lb., will also be required to replenish nutrients leached from the surface soil by the summer rains.

Zinc deficiency has been recorded in several avocado orchards, the symptoms being a decrease in the size of the fruit and yields, and the occurrence of weak vegetative growth with small mottled leaves. This disorder is corrected with the zinc sulphate-lime spray (10/5/100) used to control foliocellosis in citrus.

## HARVESTING.

It is difficult to determine the correct stage of maturity at which to harvest avocadoes. Fruits which are dark-skinned when mature develop their full colour as they ripen but the rest exhibit only a slight tinge of yellow as a background colour in the green skin and the fruit stalk. Skill in determining maturity is necessary, the usual criteria being time of cropping for the variety, fruit size and a dulling of the surface gloss on the skin. In California, an oil content of 8% is prescribed as a minimum standard for fruit maturity.

Avocadoes should never be pulled from the tree, as damage at the stem end makes the entry of decay organisms almost certain. The fruit should be double-cut with round-nosed clippers, leaving a very short stub on the stalk end. As the skin is easily bruised, avocadoes require careful handling.

The fruit is marketed in comparatively small containers. The half-bushel case (Plate 5) is the maximum size, but some varieties can be effectively displayed in trays containing a single layer of fruit which has been wrapped to reduce damage in transit.

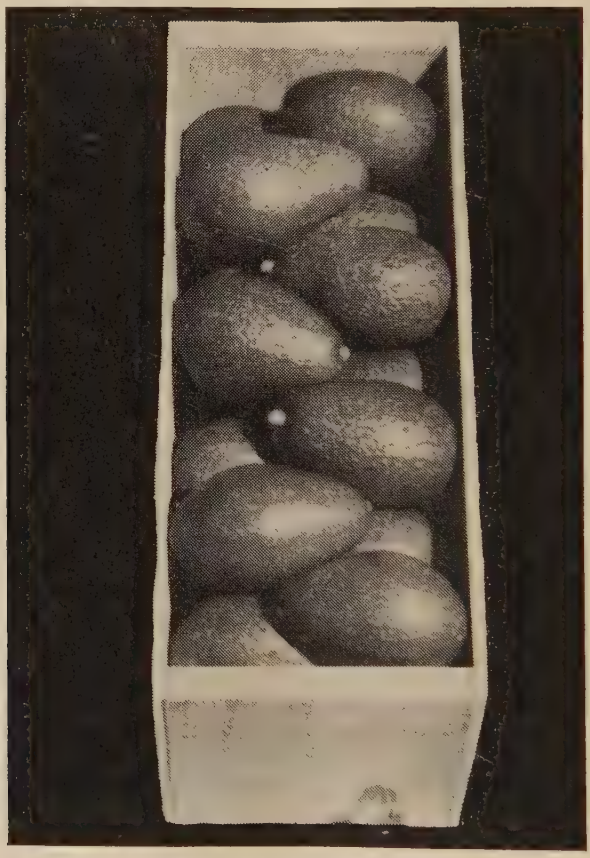


Plate 5.

**Fuerte Fruit Picked for Market.** The half-bushel case is generally used for this variety and individual fruits may be wrapped to reduce the damage in transit.

The age at which avocado trees come into bearing depends on the variety but a commercial crop cannot be expected before the sixth year. Annual returns are difficult to assess because of the pronounced tendency towards alternate bearing. A mature tree may bear up to 40 bushels of fruit in a good season.

# Fleece Measurement for Queensland Stud Masters.

## Part 2. What Are the Gains from Selection?

By G. R. MOULE, Director of Sheep Husbandry.

When you select stud sheep you set out to choose superior parents that will pass some of their good points on to their lambs. However, everyone knows that all the good points a top line of stud ewes and rams possess are not passed on to their lambs.

Let us take greasy fleece weight as an example. Buying rams that cut 10 lb. of greasy wool more than those you can breed in your own flock does not result in a 10 lb. increase in the cut per head of your flock. There are several reasons for this. Not all of the 10 lb. difference between the cut per head of the rams you buy and those you breed is due to genetic differences between the sheep—a lot of it is due to the way the sheep were fed during their early life and to the environment in which they were reared.

Similarly not all the difference of 5½ lb. between the average and the highest cut per head of the flock of 380 young rams, considered in Part 1 of this series of articles, is due to inheritance. The proportion of this difference that is due to inheritance is known as the heritability of fleece weight.

There are several methods of measuring the heritability of the characters of economic importance in domestic animals. They can be applied easily to sheep. A number of studies in different parts of the world have given quite similar results for the heritabilities of greasy fleece weight, clean scoured wool weights, staple length and fibre diameter. Fortunately, the heritability of these characters is fairly high. Somewhere between 30% and 40% of the difference between the best and the average animals in a flock is due to inheritance. The remainder is due to environment.

Suppose we accept 30% as a fair indication of the heritability of greasy fleece weight. A few simple sums will soon illustrate the importance of such high heritability.

The average cut per head of the 380 young rams whose fleece weights were shown in Table 1 was 15 lb. The heaviest cutter produced 20½ lb. of greasy wool—88 oz. more than the average. However, only 30% of this difference ($\frac{30}{100}$ of 88 oz. = 26·4 oz.) is likely to have been due to inheritance. If the heritability of fleece weight was

as low as 10%, then $\frac{10}{100}$ of 88 oz. (= 8·8 oz.) of the difference would most probably be due to inheritance.

Some characters, such as birth weight of lambs, have a heritability figure of about 20%. This is regarded as a medium figure, so it is convenient to grade different characters as being of high, medium or low heritability.

The following table shows the gradings that are accepted at present for a number of characters that are important in selecting sheep:—

PROBABLE HERITABILITY OF IMPORTANT CHARACTERS IN SELECTING MERINO SHEEP.

| Characters Whose Heritability is Probably High. | Characters Whose Heritability is Probably Medium. | Characters Whose Heritability is Probably Low. |
|---|---|---|
| Length of gestation period .. | Birth weight .. .. | Fleshing |
| Liveweight at one year .. | Weaning weight .. .. | Breed Type |
| Staple length .. .. .. | .. | .. |
| Greasy fleece weight .. .. | .. | .. |
| Clean scoured fleece weight .. | .. | .. |
| Yield .. .. .. .. | .. | .. |
| Fibre diameter .. .. | .. | .. |
| Ratio of secondary to primary fibres .. .. | .. | .. |
| Wrinkling of skin .. .. | .. | .. |
| Crimping .. .. .. | .. | .. |
| Hairiness of birthcoat .. | .. | .. |

## Measuring Progress from Selection.

Suppose, in selecting your top sires, you choose one of the rams that cut 19 lb., one that cut 19½ lb. and one that cut 20 lb. from those shown in Table 1. The average cut per head of the three rams would be 19½ lb. This means those chosen as top sires would cut 4½ lb. (72 oz.) more wool than the flock average. This difference between the sheep chosen and the average of the unclassed flock is known as the selection differential. The way you calculate selection differential is shown in Fig. 4.

Of course, the top ewes would also have a higher average cut per head than those in the remainder of the flock. Let us suppose they cut 1½ lb. more wool than the average sheep of the same age and reared under the same conditions. Then the advantage from selecting ewes—that is, the selection differential from the ewe side—is 1½ lb. (24 oz.).

In this example then we have:—

Selection differential from ewe side = 24 oz.

Selection differential from ram side = 72 oz.

Therefore the total gain from selection = 96 oz.

However, this has come from two component sides—the rams and the ewes that make up the breed. Therefore, to obtain the average increase in the productivity of the breed resulting from classing, it is necessary to divide the total increase of 96 oz. by 2 ( $\frac{96}{2}$ = 48 oz.). But, because the heritability of fleece weight is about 30%, only $\frac{30}{100}$ of this 48 oz. is likely to be passed on to the offspring. This equals about 14 oz. This exact amount will not be passed on to each lamb. Some will receive more, some less. However, the average increase in the cut per head of the whole flock will be about that much. Of course, this is not an annual increase. It is the increase that can be made by breeding one whole sheep generation. This usually takes about five years, so the average gain per year spread over a whole flock is more like $\frac{14}{5}$ oz. of greasy wool. This equals 2·8 oz.

Several points arise from these figures. Although the initial advantage from the selection of parents was high (4½ lb. in the case of the rams, and

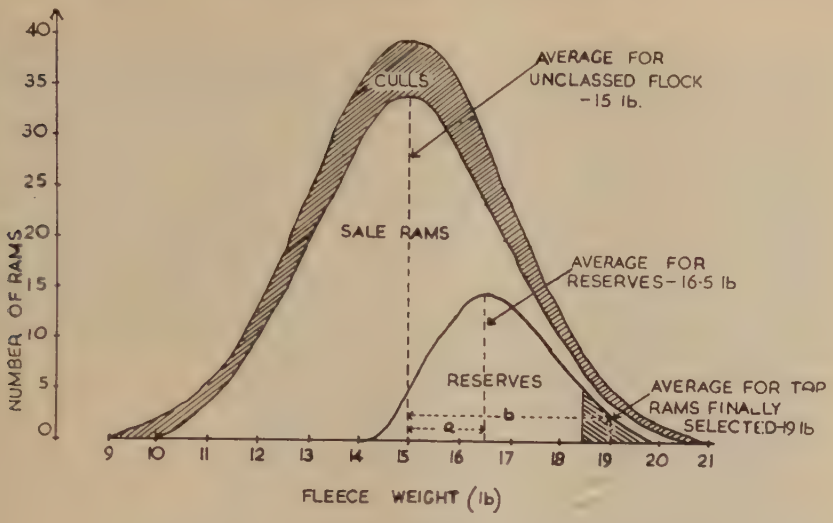



Fig. 4.

**Calculating the Selection Differential.** The upright line on the left-hand side of the page shows the number of rams. The horizontal line under the figure shows the weights of their fleeces. The shaded section shows the number of fleeces of different weights cut by the culls. The average cut per head of 15 lb. is indicated by the dotted line that runs through the middle of the large bell-shaped curve. The smaller bell-shaped curve shows how the fleece weights of the reserve rams were distributed. The average cut per head of the reserve rams is shown by the dotted line through the centre of the small bell-shaped curve as 16.5 lb. per head.

The selection differential for the reserves is then shown by the distance a; it can be calculated by subtracting 15 from 16.5 = 1.5 lb.

The shaded section on the right-hand end of the small bell-shaped curve shows the rams that were finally selected with the aid of fleece measurement. Their average cut per head was 19 lb. The selection differential obtained by choosing them is shown by the distance b; it can be calculated from 19 — 15 = 4 lb.

1½ lb. in the case of the ewes), the final result in terms of increased cut per head per year is not very spectacular. But work through the same sums, using either smaller selection differentials or a lower figure for the heritability of wool.

Let us suppose, for example, that the gain from the selection of the rams was only 1½ lb., and from the selection of the ewes only ½ lb. This would give a total gain of 2 lb., and this would be reduced to 1 lb. when divided by 2 to allow for the breed average.

The 30% heritability of 16 oz. of greasy wool is only 4·8 oz. When this is divided by 5 to give the annual permanent genetic gain likely to be passed to the lambs, it comes down to less than 1 oz. of wool per head per year!

If the heritability of greasy wool was only 10%, the difficulty of securing large increases in the cut per head, as the result of selection and breeding, becomes greater. Supposing we consider the results of our first selection when a selection differential of 4½ lb. was obtained on the ram side and 1½ lb. on the ewe side. If the heritability of greasy wool weight was only 10%, then $\frac{10}{100}$ of 48 oz. would, most probably, be passed on to the next generation. This means the annual rate of improvement resulting from permanent genetic gains would be less than an ounce of wool.

An all-important conclusion emerges from these calculations. The most rapid improvement will result from accurate selection for characters that are highly heritable. Fleece measurement is an important aid to selection.

## Developing the New Malaan Settlement, Atherton Tableland.

Falling Rain Forest for Pasture Sowing.

A Dense Stand of Molasses Grass on a Scrub Burn.

# Circular Farrowing Pen Saves Newborn Pigs.

By T. ABELL and D. B. HARRIS, Pig Branch.

The struggle to reduce cost of production is of as much importance in pig raising as in any other branch of animal production; any means of reducing losses, thus increasing production, should be examined thoroughly by farmers breeding pigs.

## Why Losses Occur.

Many of the losses which formerly occurred between farrowing and weaning, due to disease and malnutrition, have been eliminated by the use of improved accommodation and realisation of the importance of sanitation and adequate nutrition.

However, one source of extensive losses still exists—the high percentage of pigs which die before weaning. The majority of these succumb within three days of birth. Even if deaths do not occur, considerable waste is often experienced due to the feeding of pigs unthrifty because of setbacks received in the first few days of life.

These losses may be attributed in general to three causes:—

(1) Infections at or shortly after birth.

(2) Chilling, with a subsequent loss of vigour.

(3) Overlying or trampling by the sow.

The orthodox farrowing pen, of square or rectangular floor plan and with a wooden or concrete floor, will reduce the risk of piglet infections considerably but has a limited influence on the other two causes of losses.

Observations made on farrowings in well constructed pens of conventional design and fitted with guard rails indicated that the biggest percentage of piglet losses was from overlying or trampling, and that most of the casualties occurred in the centre of the floor space. Further, it was often noted that in these pens a newly born litter huddled in a corner shivering from the effects of a cold wind.

Farrowing crates, sloping floors, and the provision of artificial heat in a creep have all been used with varying degrees of success in endeavours to avoid early deaths. They all mean extra labour at farrowing times, are not entirely effective, and newly born piglets often are not strong enough to use the facilities provided.

Observations made in Great Britain indicated that a sow's body heat is only adequate to warm the air in a pen of much smaller volume than the type generally recommended in Queensland for farrowings. Where cold conditions are experienced in the State these conventional pens often prove uncomfortable for newly born pigs. Owing to the wide range often

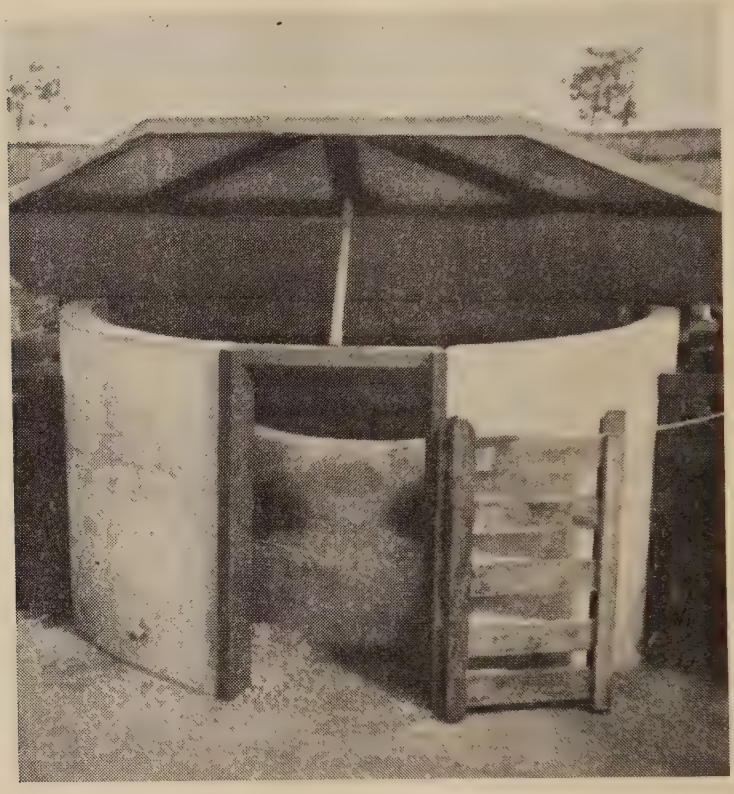


Plate 1.

**View of Circular Farrowing Pen, With Roof Propped Up.**

experienced between the daily maximum and minimum temperatures in the pig raising areas of the State, a farrowing pen to be effective must be so constructed that the sow's body heat will warm the pen when temperatures are low, and also permit adequate cooling on hot days.

## The Circular Pen.

At the Ruakura Animal Research Station, New Zealand, a type of farrowing pen was developed which promised to solve most of the difficulties observed under Queensland conditions. Therefore an adaptation of this pen was constructed at the Kairi Regional Experiment Station on the Atherton Tableland to study the effectiveness of the principles under local conditions.

The pen consists of an outer circular wall with a doorway, inside which is a semi-circular wall set seven inches off centre towards the front of the pen. The remaining half of the inner circle consists of a metal grill which permits the suckers to enter or leave the central "safety zone" at will, while keeping the sow out of this area.

By placing the safety zone off centre, towards the front, the space between the grill and rear wall is sufficient to permit the sow to lie down. This is the only part of the pen where the sow can lie, and she must lie with her teats close to, and facing, the safety zone. Thus the suckers during the first few days of life need not travel more than a few feet, and are not in a position to be overlaid or trampled. The distance

between the two side walls and central semi-circle does not allow the sow to turn around, so that once she enters the pen she must walk ahead to emerge again.

The volume of air in the Kairi pen is approximately one-third of that of the nearby conventional pens of rectangular floor plan. It was found that the sow's body heat was sufficient to keep the temperature of the smaller volume of air inside the circular pen at least 3°F. or 4°F. above outside temperatures. Thermometers installed in both types of pen gave a check on temperatures. In the circular pen the temperature rose or fell a few degrees whenever the sow entered or left the pen. Body heat would not influence temperature in the conventional pen.

This warming of the air is an important factor in the few days following the birth of a litter. Though Queensland does not experience the really cold weather more common in southern States, the night temperature often falls well below the minimum of 60°F. recommended for sucking pigs, whilst the day temperature a few hours later may exceed 90°F. Such contrasts, with temperatures well outside the best range of 65°F. to 75°F., may lead to discomfort, wandering to seek cool conditions, chilling or pneumonia.

The new-type pen at Kairi maintained the temperature above 65° generally, in spite of cold, wet weather on some days. For a period of a few days in cold damp weather, a kerosene brooder lamp fitted with a flat hover board was installed over the sucker

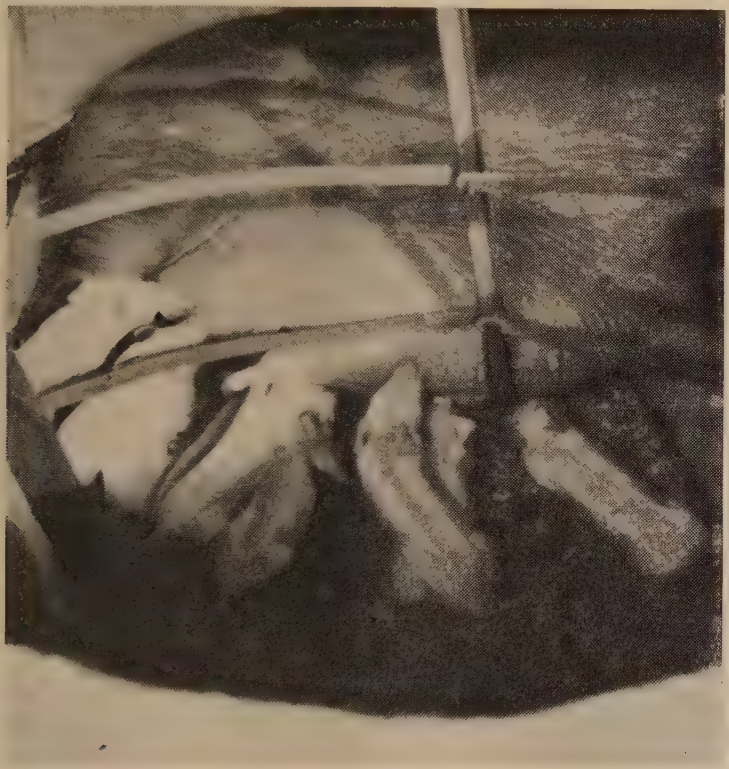


Plate 2.

**Sow Lying in the Circular Race, With Piglets in the Safety Zone.**

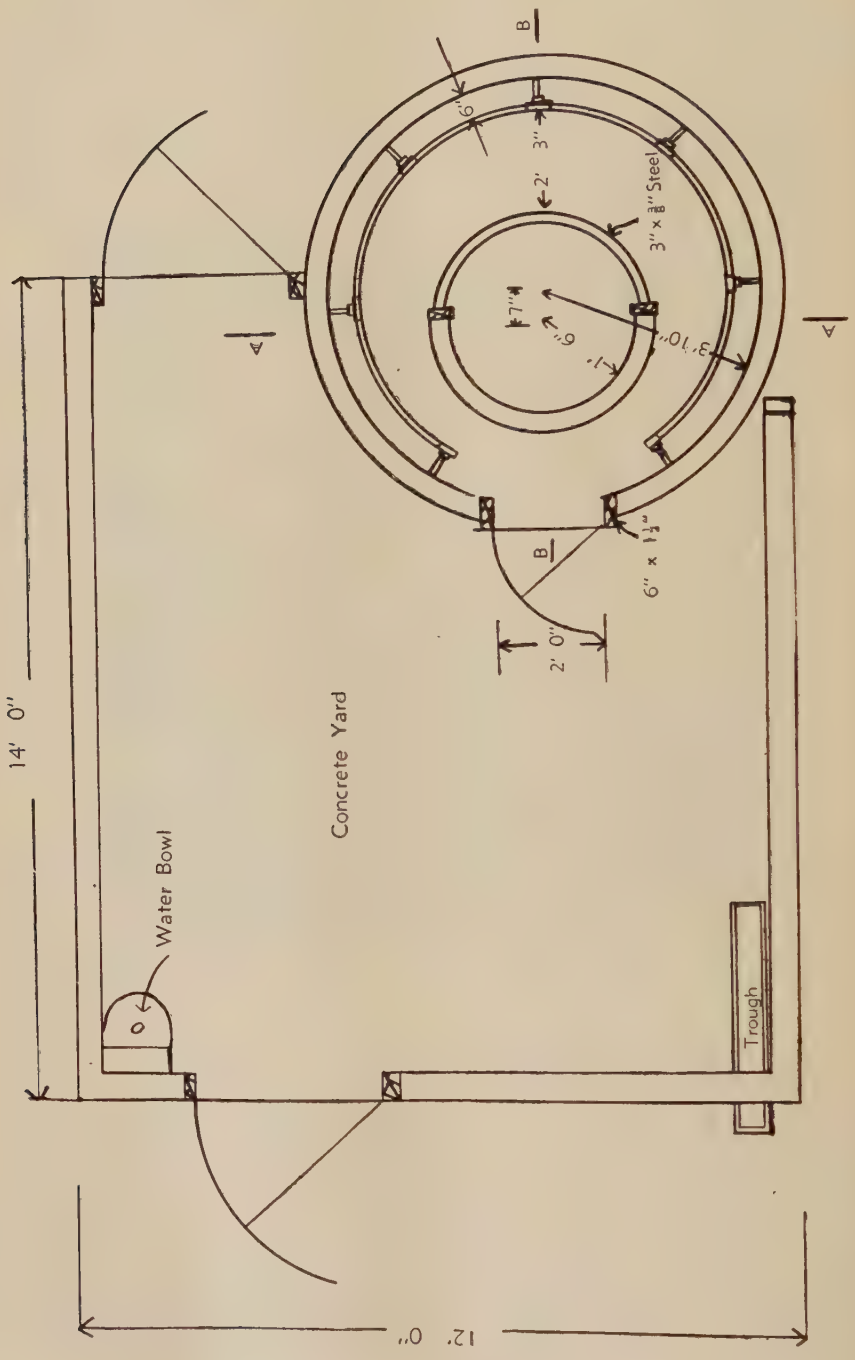



Plate 3.

**Plan of Circular Farrowing Pen and Surroundings.**

safety zone. This created a zone of localised warmth for the suckers, without materially raising the temperature of the pen. Where kerosene or electrically operated sources of radiant heat are required, they can be installed to benefit the piglets, and are safe from interference by the sow.

The Kairi pen was constructed to function in the wide range of temperatures experienced in the tropical and sub-tropical climate of most of the State's pig-raising areas.

To prevent overheating on hot, sunny days the roof was constructed in two sections, each hinged so that it could be moved independently of the other. On hot days, by raising the appropriate roof section to the required height, a flow of cool air quickly lowered the temperature.

Owing to the low roof it is more difficult to move in the pen, but due to the absence of corners it is easier to clean; no soiling of bedding occurred even when pigs were left in it for three weeks, whereas soiling of bedding occurred in corners in the conventional pens.

## Building the Pen.

Construction is of concrete, with timber roof frames sheathed with galvanised flat iron.

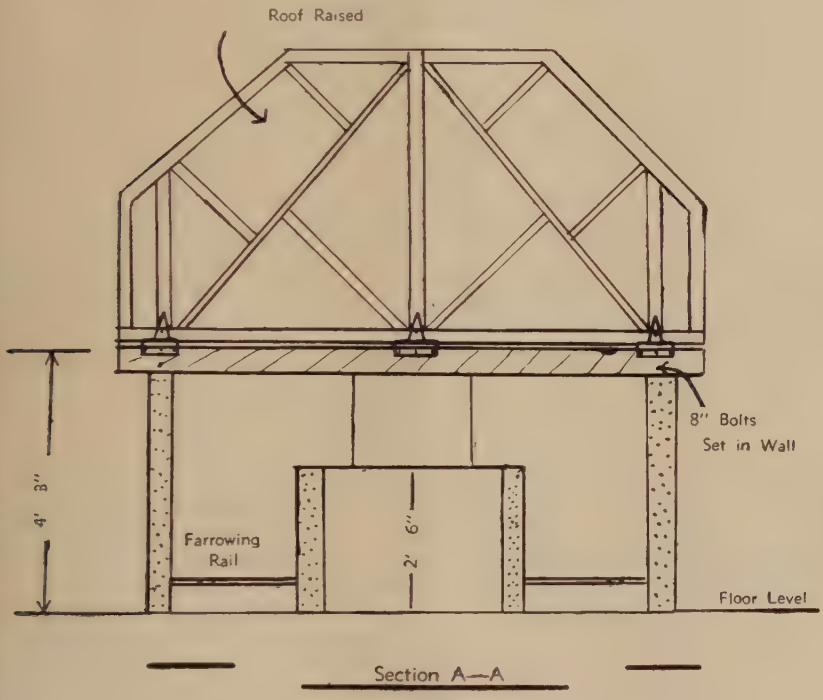



Plate 4.

**Section Through Pen (A-A), With Roof in Raised Position.**

The ends of the top and bottom bars of the grill should have three or four holes drilled at 1 in. intervals so that the grill may be moved closer or further away from the rear wall to accommodate small or large sows as required.

The height—4 ft. in front, 4 ft. 3 in. at the centre ridge and 3 ft. at the rear—provides ample headroom for

sows. Guard rails are constructed from ½ in. piping passed through 1 in. T pieces on 1 in. piping let into the walls.

The floor consists of approximately three-quarters of an inch depth of concrete over empty bottles, hollow tiles or lumber bricks. This type of floor is warm and dry. The floor of the sucker safety zone falls one inch from the wall to the front grill, where there should be a 1 in. drop to pen floor level. The main floor of the pen falls two inches from rear walls to front, with a fall also from centre towards the walls. This serves the purpose of providing effective drainage away from the area where the suckers lie. If the hinged roof is propped up after washing out, the pen drains and dries quickly.

To prevent entry of moisture where the roof sections are hinged to the 6 in. x 1½ in. beam, the flat iron roof of each section is continued in a roll as illustrated.

The addition of a gate is advisable, so that a sow may be shut in the pen for a short time if necessary.

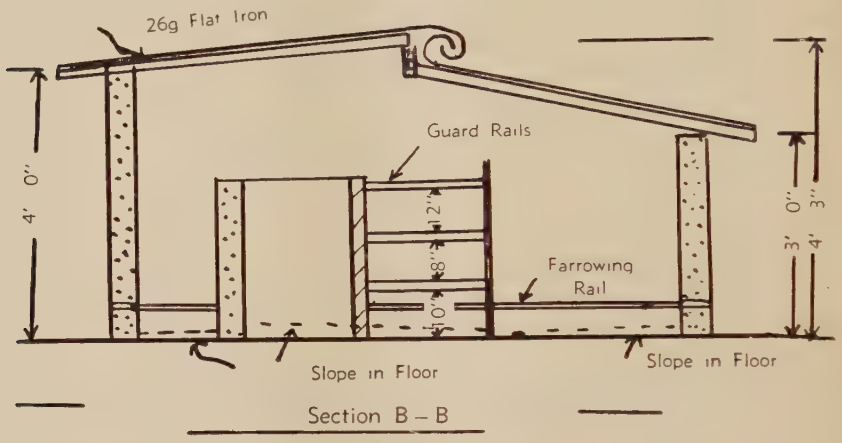



Plate 5.

**Section Through Pen (B-B).**

## Results of Tests.

Records kept over an equal number of litters farrowed in both types of pen at Kairi showed 8 per cent. of piglets died in the conventional pen, whilst the losses in the circular pen were 1·5 per cent. The circular pen farrowings included three first litter gilts. The small percentage loss in the circular pen would not have occurred if the wood shavings used for bedding had been available continuously. The overlying occurred on the only occasion on which grass bedding was placed in the pen, and the sow "wadded" the bedding into a hard mass under the guard rail.

It should be noted that, as the danger period for suckers covers the first few days after birth, a litter could be moved if necessary to a conventional pen at the end of that period to make room for another farrowing sow. As the circular pen is not intended as a pen for rearing pigs to weaning, one circular pen would be sufficient on all but large piggeries.

## Summary.

The circular farrowing pen at Kairi proved effective in reducing losses amongst newly-born piglets. It maintained an air temperature around 65° or above during cold, damp weather, thus preventing chilling and pneumonia, which are of common

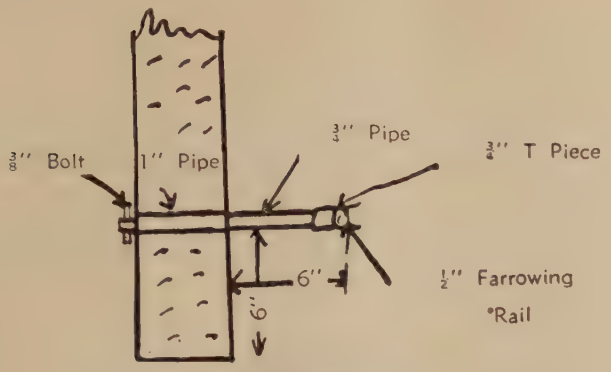



Plate 6.
**Detail of Farrowing Rail.**

occurrence during cold weather. Piglets in this pen appeared warmer and more contented than those in neighbouring pens.

It lends itself to cheaper construction and requires less skilled labour than is necessary for other pens.

Though movement in the pen is more difficult than in the conventional types, it is easier to clean and dries quickly, particularly if the roof ventilation is adjusted to force air inside.

Because of the roof construction, more sunlight can enter the pen than with other types.

There are no corners; the suckers have easy access to a safety zone yet are close to the sow for feeding. The sow cannot turn around in the pen, and can only lie in the one position.

No difficulty was experienced with sows using the pen for the first time.

It appears that during days of considerable range in temperature, more frequent visits to the piggery might be necessary to adjust ventilation so that the pen would not be cold or excessively hot.

The many advantages of this pen outweigh the few minor disadvantages, and pig-raisers who breed their own stock are advised to consider the advantages of constructing a circular farrowing pen.

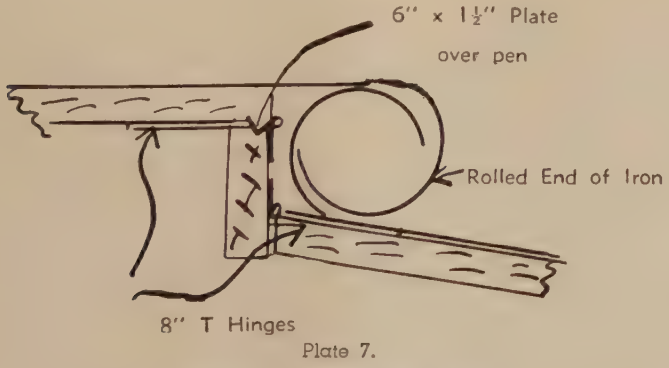



Plate 7.
**Method of Waterproofing Roof.**

# Glassers Disease in Pigs.

By S. G. KNOTT, Assistant Veterinary Officer.

**If your pigs show high temperature, lameness, peritonitis, pleurisy and possibly pneumonia, the trouble may be Glassers disease.**

**This disease is infectious, and no time should be lost in seeking veterinary advice.**

**Bought weaners are a common source of infection. Keep them away from other pigs on your farm.**

**If the disease is dormant in a herd and the pigs are travelled, the disease may flare up.**

**Drug treatment is very effective. Use it early!**

Glassers disease is an infectious disease of pigs commonly encountered in Queensland, yet it is surprising how many pig farmers have not heard of it.

It is named after the discoverer of the disease, Glasser, who described it in Europe in 1906.

Although the disease often follows pig introductions, outbreaks do frequently occur in piggeries where no outside pigs have been brought in. Often it can be traced to a change in environment or to faulty management, but then again cases do appear without any apparent exciting cause.

That it has been present in Queensland for a long time is evidenced by the fact that a fatal disease of pigs which was almost certainly Glassers disease was encountered at Atherton in 1938.

The disease may flare up unexpectedly on farms, but often it follows the introduction of pigs, particularly weaners, from sales or other farms. Despite the fact that pigs may appear perfectly healthy when purchased, travelling does seem to encourage the dormant bacteria to become virulent and produce the acute illness. Such movements are often allied with changes in management and a new feeding routine, and as a result an outbreak of Glassers disease occurs in the purchased weaners, or in the farmer's own pigs which have caught the infection.

Unless purchased pigs are kept apart, the disease can easily spread to other susceptible pigs, so the farmer then has an epidemic of disease to contend with in his own piggery. In this way one farmer recently lost all of 34 pigs purchased, and another farmer 34 out of 120 of his original pigs. The latter case involved purchasing a small number of weaners from a saleyard and placing them in with the other pigs which all ran together under poor management conditions.

If a farmer finds that purchasers of his weaners are experiencing losses in them within a few days of delivery, then it is likely that Glassers disease is present in his piggery and he should seek veterinary advice to prevent spread of the disease and to protect his reputation as a supplier of weaners.

Despite the fact that the disease has been known to exist in Queensland for a long time, it was not until 1946 that bacteriologists at the Animal

Research Institute at Yeerongpilly were able to isolate the bacterium or germ responsible. This is because the bacterium (*Haemophilus suis*) is extremely fragile and has very exacting requirements for its growth in the laboratory. Until the isolation of the particular germ we could not be certain that the disease was, in fact, Glassers disease.

such as travelling or cold damp conditions and inadequate feeding allow the bacteria to overcome the body's defences and cause obvious signs of sickness.

## Symptoms.

Generally these are fairly characteristic and fairly sudden.

Plate 1.

**Injecting Sodium sulphadimidine into the Peritoneum.** The syringe is held at right angles to the skin.

Although *Haemophilus* does occur also in piglet influenza, the presence of the organism, in conjunction with the typical changes in the organs described below, indicates Glassers disease.

If the bacteria is such a fragile one outside the body, then why is the disease so common? The reason is that some pigs act as carriers of the disease. When environmental conditions are suitable, the carrier pigs may transmit the bacteria to the pigs they come in contact with, while the carrier pigs themselves may or may not develop clinical symptoms.

In this way the disease can slumber on in a piggery until certain stresses

Affected pigs refuse their feed, are tucked up and show indications of a fever such as lying in cool damp areas. The temperature taken by inserting the thermometer in the rectum may vary from 104° to 108°F. depending on the stage and severity of infection. The normal temperature of the pig is inclined to fluctuate a little according to the prevailing conditions, but for a working guide 100°-102·5°F. may be taken as normal.

Perhaps the most characteristic symptom observed is lameness in one or more legs. This is due to arthritis or inflammation of the joints and can be so acute that the pig is unable to

stand at all. If the joints are handled, they feel hot and swollen and cause pain to the pig.

Also, if pressure is applied to the abdomen or ribs, pain is often evidenced by squealing. This is due to the inflammation of the membranes surrounding the lungs and intestines.

A certain proportion of affected pigs will also cough due to pneumonia which may be present as well. This symptom is not always shown and may be seen in several other diseases.

(peritoneum) known as peritonitis. Associated with this may be an abnormal amount of peritoneal fluid, while yellowish strands of fibrin may be observed between the intestines. In time these cause adhesions between the loops of the intestines.

The liver may display small yellowish areas of dead cells where it has broken down.

On opening the chest cavity, inflammation of the lining (pleura) will

Plate 2.

**Injecting Sodium sulphadimidine Under the Skin Behind the Shoulder.** The syringe is held almost parallel to the skin.

Some pigs display a pimply eruption of the skin. More frequently the skin of the abdomen and inner thighs is bright red, which deepens to purple as the disease progresses. Affected pigs may die in 24-36 hours.

The disease is most commonly found in weaners and the mortality rate may be up to 80 per cent. unless the correct treatment is used.

## Post-mortem Examination.

Opening the abdominal cavity will disclose an inflammation of the lining

indicate pleurisy. This may be associated with adhesions from the pleura to the lungs.

The pericardial sac lining the heart may also be inflamed and contain an excessive amount of discoloured fluid, indicating pericarditis.

Examination of the lungs themselves may reveal dark red or grey areas which are collapsed below that of the surrounding normal pink lung tissue, indicating the presence of pneumonia.

Opening the affected joints reveals an excessive amount of turbid fluid and sometimes flattened disc-shaped deposits of yellowish-green fibrin. The articular surfaces are often swollen and eroded.

The lining of the brain is often inflamed, due to meningitis.

To sum up, the typical lesions of Glassers disease include peritonitis and/or pleurisy and/or pericarditis, associated with arthritis.

Sulphadimidine, sulphamerazine, or sulphapyridine tablets may be used effectively. The dose rate is one gram (two tablets) per 10 lb. weight. Treatment is continued at a reduced dose rate of 2 tablets per 15 lb. weight for four days to prevent relapses.

If preferred, sodium sulphadimidine may be injected into the peritoneum or under the skin. The dose rate is similar to that used with the tablets, except that 3 cc are used instead of each two tablets.

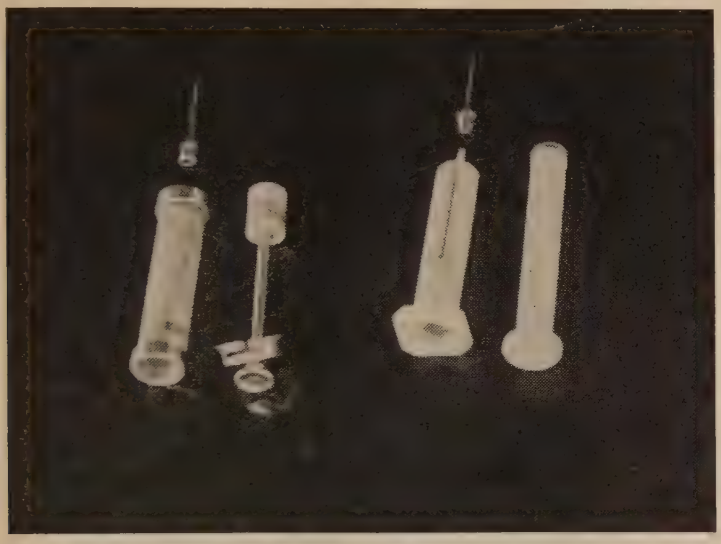


Plate 3.

**Recommended 10 cc Syringes (Glass and Nylon) Dismantled for Sterilizing.**

## Diagnosing the Disease.

The disease may be confused with swine erysipelas or with navel infection.

In erysipelas, the arthritis is not associated with fibrinous inflammation of the serous membranes, while in navel infection, lesions in the joints contain pus.

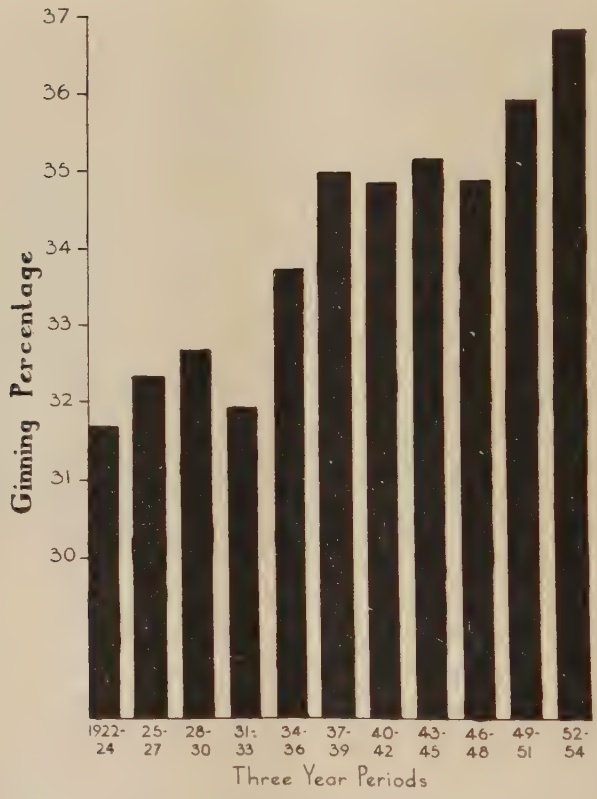
## Treatment.

Fortunately, the disease is readily controlled by early treatment with sulpha drugs. Often the results are spectacular.

If the injection is given into the peritoneum then the pig is held up by its front legs by an assistant who clamps its body firmly between his legs. The site is cleaned, using 1 in 100 Zephiran or Cetavlon disinfectant solution or strong Dettol solution. The site of injection is midway between the navel and the base of the sternum (breastbone) in the midline, and the needle is thrust through the skin and muscular wall so that the injection is made into the abdominal cavity. This method of administration is only recommended to farmers who have the necessary experience and technical skill to perform the operation safely.

Injection under the skin may be made behind the elbow in the flank or just behind the ear. These sites are selected because of the looseness of the skin there. Preliminary disinfection of the skin is desirable, as with intraperitoneal injection.

Record glass or nylon syringes are recommended. The latter are particularly useful for the farmer as they do not break when dropped. All syringes should be boiled before use and cleaned and dismantled after use. Sixteen gauge hypodermic needles are the most suitable.




**Cotton Improvement in Queensland.** This graph shows the improvement in ginning percentage over the past 30 years. The big change about 1933 was the result of replacing old varieties with new ones such as Miller, New Mexico Acala and Triumph. The improvement since then has been due to breeding work within these varieties, and principally to the development of Miller, 43-9-0, which has a high ginning percentage.

# Are Egg-Laying Competitions Outmoded?

By J. S. F. BARKER, Assistant Husbandry Officer, Animal Research Institute, Yeerongpilly.

Why are poultry production tests carried out? The basic aim always has been and still is to try to estimate the average worth of a particular flock. In recent years, the methods of these tests have changed considerably. Here, an attempt is made to show what has been done, why changes have been necessary, and what can be hoped for from the present-day tests.

## EGG-LAYING COMPETITIONS.

Egg-laying competitions have been in operation for over 50 years. New South Wales took the lead in Australia, its first competition being established in 1902. The competitions became very popular in Queensland, and were established at Wynnum, Zillmere, Mt. Gravatt, Toowoomba, Gympie, Maryborough, Childers, Bundaberg, Rockhampton, Townsville and Cairns.

The aims of egg-laying competitions were mainly:—

(1) To show which breeds were the more productive.

(2) To create a spirit of competition between producers and encourage more rigorous selection within breeds, thereby leading to higher productivity.

(3) To demonstrate to poultry farmers the potential productive capacity of their birds under proper feeding and housing conditions.

(4) To indicate to producers the best poultry breeders.

However, egg-laying competitions as such have almost completely outlived their usefulness—for a number of reasons. In earlier years the participants were often men who kept fowls largely as a hobby. Their flocks were small by present-day commercial standards. The number of birds entered from any one flock (from one to six in the Australian competitions) is insufficient to give a true picture of the actual worth of the modern commercial flock, averaging as it does from 1,000 to 2,000 birds.

Other considerations are:—

(1) There is no certainty that the competing birds were actually bred in the flock they represent, and that they have not been obtained from a superior flock.

(2) The outcome of the competition is more often due to the skill and judgment of the flock-owner in picking out those birds that will give high production, rather than to the worth of the flock as a whole.

(3) The competing birds are usually not sent to the site of the competition until mature, and so may have been subjected to special treatment beforehand.

Because of these factors, the results of the competitions are often deceptive and a winning breeder or producer in any one year may not be able to achieve success at subsequent competitions.

## WHAT IS NEEDED?

Egg-laying competitions, then, are of little value to the commercial poultry-breeder. What is needed is some type of test that will give a true indication of the overall breeding value of flocks. It is essential that more than egg production be recorded. Fertility, hatchability, rearability of the chickens, sexual maturity, egg production and egg weight, pauses, egg quality characters, efficiency of feed conversion, &c., should all be measured.

Further, the main criticisms of the egg-laying competition may be overcome fairly easily. The basic aim of the test should be to provide the buyer of chickens or breeding stock with information as to the actual worth of the flock from which chickens and other stock are offered for sale. For the test to give a reliable estimate of the worth of the flock, it should be designed so that:—

(1) A larger number of birds are recorded from each flock.

(2) Birds entering the test are subjected to identical rearing conditions, and, as far as possible, to identical conditions right through the trial.

(3) Competitors are not allowed to select birds for testing. A random sample of eggs should be taken—that is, the eggs should be taken at random from those available and not specially selected. However, if facilities do not allow the use of eggs, a random sample of chickens may be taken.

(4) There is an absolute guarantee that the sampled eggs are from birds bred by the entrant and owned by him at the time of sampling.

(5) Accurate records of performance are kept right through the trial.

## MODERN PRODUCTION TESTING.

Two main types of production trials have been devised on these bases: the American Random Sample Test and the Goosnargh Poultry Production and Progeny Trial in England.

### Random Sample Tests.

This method of testing a breeder's stock was first formally proposed by Hagedoorn in 1927 but for various reasons little progress was made. Since then trials have been set up in California (in 1947) and New York (in 1950). Random sample tests commenced in New South Wales in 1952, and in Queensland in 1954. Canada commenced a test in 1955.

Though the general aims of these tests are the same as for the old-style laying competitions, there is a considerable difference in methods. The fundamental of the random sample test is in the sampling technique, the aim being to evaluate the average genetic worth of a breeder's flock. It is most convenient to take eggs from the setting trays on the various farms just before they go into the incubator. The eggs are then transported to the test station, where they are all hatched together. This ensures that there will be no variation in hatching results due to hatching in different incubators.

How many eggs should be sampled? This depends on the number of pullets one needs to test to obtain sufficiently accurate estimates of the flock's productive ability. A recent recommendation is that in flocks where less than 40 males of one breed are mated up (that is, flocks of about 1,000 layers) 160 eggs will suffice. At no stage of the test should selection or culling be practised. An ideal arrangement would be to reduce the number of pullet chickens to say 50 at hatching and then allow no selection, culling or random sampling. The length of the test

should not be less than from the first egg laid to March 1 of the following year.

To reduce environmental differences between groups during rearing, it is preferable that they be mixed. However, it is then impossible to directly measure rearing feed consumption, and strain differences in social order, growth pattern or some other factor may have various effects. Feed consumption during rearing could, however, be estimated, using change in body weight over the period and one uniform feed efficiency for heavy breeds and another one for light breeds.

During the laying period, it is advisable to house each breeder's group separately because:—

(1) Accurate feed consumption records can then be kept on each group, and it is during lay that strain differences in feed efficiency are most important.

(2) Strain differences in size and social order characteristics would affect performance to a greater extent during the laying period.

By housing separately, the environment is not as uniform for all groups. However, there is some evidence that pen effects are of little importance. In any case, two or three pens each year for each breeder's group would eliminate most errors of this nature. All feeding and management practices in these two or three laying pens should be uniform.

It is seen, then, that though this test ignores the breeding value of individual birds, it provides a measure of the average quality of each entrant's flock, thus allowing an unbiased comparison of one flock with another.

## Goosnargh Poultry Production and Progeny Trials.

The English test came into being about the same time as the Random Sample Test in the U.S.A. It involves a combination of the old-style laying competition and a random sample test of progeny. It is in two sections:—

(1) *The original entry.*—The breeder selects 12 pullets, which are sent to the test station at Goosnargh. Each group is penned separately and egg production and egg weight data are collected for 48 weeks.

(2) *The progeny test.*—During the testing of the original entry, each breeder selects a cockerel of the same breed as the hens of the original entry, and sends it in to be mated with his 12 pullets. One hundred eggs are set (four weekly settings of 25 each). The pullet chicks of each group are reared together. When the progeny are mature, 20 pullets are randomly selected and then subjected to a 48-weeks test for egg production. The final placing of the entrants depends on points allotted for number of eggs produced* and livability of the original entry, hatchability of the 100 eggs set, rearability of the progeny, bulk weight of eggs produced by the progeny, and livability of the progeny.

This type of production test is well supported in England and it was announced recently that a modification of this test will be used by the Ministry of Agriculture and Fisheries in the accreditation scheme of the Poultry Stock Improvement Plan. In this scheme, the original entry will be obtained by taking a random sample of 100 eggs from each entrant. These will be incubated and the pullet chicks reared. At maturity, 12 of

* Points are not allotted for eggs weighing less than 1¾ oz.; and for eggs weighing more than 1¾ oz. but less than 2 oz. points are allotted for the first eight weeks of the test only.

these pullets will be sampled at random and subjected to a production test. The rest of the programme is the same as in the Goosnargh test except that 25 pullet progeny are tested.

In schemes of this nature, in connection with accreditation of breeders, it is essential that the entering flocks be closed, or at least that transfer of fertile eggs or breeding stock be closely controlled. That is, it is essential that the sampled eggs be from birds bred by the entrant and owned by him at the time of sampling.

## Scoring in Modern Production Testing.

In the Queensland Random Sample Test, points are allotted for each of the characteristics measured, the number of possible points being based on what is judged to be the relative economic worth of the various characteristics.

The scoring system in the U.S.A. tests is somewhat different. The price of 50 pullet chicks, as given in the entrant's current price list, is charged against the entry, as well as all feed consumed. At completion of the test, "income" is determined by subtracting cost of chicks and feed from "returns" for eggs and market poultry. The value of each flock is determined on the basis of "income" from the birds under test. This method ignores hatchability and rearability. For the benefit of the customer of the breeder, it is a useful measure, but it would be more valuable if published together with data on hatchability, actual production, etc.

## Disease Control in Modern Production Testing.

In order to evaluate the entries for the average poultryman, the environmental conditions at the tests should be comparable to the conditions these strains will meet on the average farm or, at least, conditions no better than average. To what extent, then, should the birds be exposed to infectious diseases? It is felt by some authorities that no special treatment should be given to the birds under test to reduce the disease risk. In fact, in the New York test the chickens are brooded in close proximity to a flock of mature hens known to be affected by leucosis. As resistance to leucosis can be bred into a strain, this procedure emphasises the problem of the disease, and shows which breeders are attempting to do something about it.

## Publication of Results.

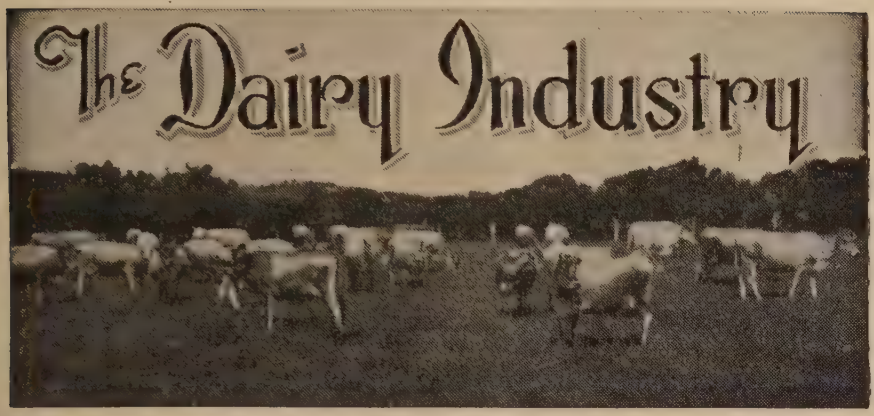
All data collected during a test should be published, together with the name of each entrant. If this is not done, one of the main benefits of the test is lost, and the test is not of the greatest value to the poultry industry.

## Testing and the Breeding Programme.

Now, for the first time, a poultry breeder can evaluate the true worth of his flock in comparison with others. This will enable breeders to discover their problems, particularly as all characteristics of the flock can and should be measured.

We are becoming increasingly aware that we do not know how much progress is being made in breeders' flocks. To overcome this, Professor C. King of Cornell University, New York, suggested in 1954 that "a control flock should become an integral part of every Random Sample Test . . . . Of all the possible types of control flocks, it seems as if a random bred one has the least number of disadvantages . . . . Evaluation of performance (then) becomes more precise, and breeders have a means of determining their actual rate of progress."

This addition of control flocks to the tests will also allow the evaluation of various breeding methods. Such data would be very useful for research workers in genetics and animal breeding, as well as to the commercial poultry breeder.




# A System of Water Treatment at a Queensland Butter Factory.

By F. G. FEW (Dairy Technologist) and G. G. CRITTALL (Analyst), Division of Dairying.

Following the initiation of a factory water survey scheme by the Dairy Research Laboratory a few years ago, factory managements in Queensland are gradually realising that the efficient operation of a dairy factory is impossible without a satisfactory water supply.

In the first place it must be admitted that many factories were built without proper regard to the natural water supply available and, as a consequence, have experienced serious difficulties from corrosion, boiler failure due to heavy scaling, unsatisfactory equipment cleaning, etc., particularly where compelled to use underground water supplies. The survey has shown that even where a plentiful supply of surface water is available, treatment is often necessary.

It can be taken as axiomatic that no water supply is above suspicion, and regular analysis is essential to ensure a continued suitable supply.

At Beaudesert the Logan and Albert Co-op. Dairy Assn. Ltd. was using a bore water for all general factory purposes, a limited supply of water from the Logan River being available to the factory for boiler feed purposes. On investigation it was found that no treatment was practised for either source of supply, despite the fact that the bore water was extremely hard (greater than 1,000 parts per million total hardness) and also consistently acidic in reaction (pH 6.0-6.5).

The composition of the river water, as would be expected, varied considerably with seasonal conditions, varying from 400 ppm total hardness in dry times down to 100 ppm or slightly less during the wet season. During the wet period, the water was invariably fouled with suspended matter and thus equally unsuitable for boiler use despite the relatively low hardness.

The outcome of utilizing these waters in the manner indicated was an excessive rate of corrosion of all factory pipelines and equipment, even including some stainless steel vats that were rinsed with the bore water. Boiler maintenance was heavy due to the necessity for frequent descaling, with occasional retubing. Fuel consumption was excessive having regard to the steam demands for factory processing.

## TREATMENT PLANT INSTALLATION.

To remedy this state of affairs, it was decided at the outset to use the river water for all purposes other than butter washing, provided sufficient supply could be made available. Total daily requirements of river water were computed at up to 15,000 gallons, rising to 25,000 gallons during times of peak production. With the low winter production immediately ahead, it was decided for a start to install tanks totalling 10,000-gallons capacity, and increase treatment capacity before the summer flush season was reached. At present, five tanks are in use, enabling up to 25,000 gallons of river water to be treated per day. For butter washing purposes, two tanks each of 2,500 gallons are used for treating the bore water reserved for this use. A general idea of the tank set-up can be gained from Plate 1.

Plate 1.

**Water Storage Tanks at Beaudesert Butter Factory.**

The tanks used for the treatment are round galvanised iron tanks, some being new and others acquired second-hand from various sources. It was necessary to cement the old tanks internally, whereas no treatment was given to the new tanks, nor has it been found necessary to do so subsequently. The tanks were set up on solid concrete bases, a small trench being left across the base to allow the placing of a 2-in. pipe to discharge the settled sludge from the bottom of the tank.

Valves were placed in a convenient place outside the base of each tank. For the withdrawal of treated water a 2-in. pipe was fitted into the tank, ending in an elbow pointing upwards. This results in the last four inches of water being left in the tank, while during pumping, suction is directed downwards, thus avoiding any disturbance of the settled sludge. The tanks are filled from an overhead pipe system discharging directly into each tank.

An efficient system of agitation is provided for each tank, air being injected, using steam nozzles. A $\frac{1}{2}$-in. steam line with appropriate fittings is large enough for this purpose, but as ample $\frac{3}{4}$-in. piping was on hand at the factory, it was used in this case. The steam-air mixture passes to a cross lying on the bottom of the tank. This is of piping with closed ends and a series of approximately $\frac{1}{8}$-in. holes at 12-in. spacing along the top. Agitation of a tank after dosing is shown in Plate 2. The use of a conveniently placed storage shed provided with sufficient airtight 44-gallon drums completes the essential equipment for water treatment.

Plate 2.

**Agitation of a Water Tank After Dosing.**

## METHODS OF TREATMENT.

As already mentioned, the composition of river water varies with seasons and it is found that clarification and/or softening are required right throughout the year. For the bore water, commercial sterilization to an approved standard is the sole treatment continuously applied.

### Clarification.

During wet seasons it is found that the total hardness of the river water is usually below 100 ppm and the essential treatment is clarification due to the large amount of clay and silt invariably in suspension. Filter alum is used for this purpose; when added to the water this gives a precipitate of aluminium hydroxide, the suspended matter being removed mechanically by flocculation of the particles. The reaction is illustrated by the chemical equation.

$$\underset{\text{Aluminium sulphate}}{Al_2(SO_4)_3} + \underset{\text{Water}}{6H_2O} \longrightarrow \underset{\text{Aluminium hydroxide (precipitated)}}{2Al(OH)_3} + \underset{\text{Sulphuric acid}}{3H_2SO_4}$$

It will be noted sulphuric acid is formed; in practice this must be neutralised unless the natural alkalinity of the water is sufficient to do so. When necessary, soda ash is used for neutralisation, this action being carried out in reticulation tanks to which the clarified water is pumped from the treatment tanks. Sufficient soda ash is used to restore the pH of the water to 8·0-8·5 (that is, just to give a faint pink colouration with phenolphthalein indicator, normally available at all factories). Dosages of filter alum are not particularly critical, but normally 1–3 lb. per 1,000 gallons are required. Experience soon allows the plant operator to accurately assess the amount required.

### Softening.

As softening involves definite chemical reactions, it is necessary to be precise in adding the required dosages to the tanks of raw water. For this reason, all treatment tanks in use were accurately measured and the volumes calculated, each tank then being marked with its volume to a certain level, approximately 4 in. from the top. Although the water hardness is largely of a temporary nature, some permanent hardness is always present, necessitating the use of both freshly slaked or burnt lime and soda ash. Analyses over four years have shown that approximately two-thirds of the total water hardness present is due to salts of magnesium, the balance being calcium salts.

The principal chemical reactions involved in softening the river water are as follows:—

$$\underset{\substack{\text{Magnesium bicarbonate}\\\text{(temporary hardness)}}}{Mg(HCO_3)_2} + \underset{\text{Slaked lime}}{2Ca(OH)_2} \longrightarrow \underset{\substack{\text{Magnesium hydroxide}\\\text{(precipitated)}}}{Mg(OH)_2} + \underset{\substack{\text{Calcium carbonate}\\\text{(precipitated)}}}{2CaCO_3} + \underset{\text{Water}}{2H_2O}$$

$$\underset{\substack{\text{Calcium bicarbonate}\\\text{(temporary hardness)}}}{Ca(HCO_3)_2} + \underset{\text{Slaked lime}}{Ca(OH)_2} \longrightarrow \underset{\substack{\text{Calcium carbonate}\\\text{(precipitated)}}}{2CaCO_3} + \underset{\text{Water}}{2H_2O}$$

It will be noted that twice as much lime is used to eliminate temporary hardness due to magnesium salts as that due to calcium salts. This is to ensure the formation of magnesium hydroxide, which is much less soluble than the corresponding carbonate.

For the removal of permanent hardness, sodium carbonate (soda ash) is used, alone in the case of calcium hardness, and together with slaked lime when magnesium salts are present. The basic equations showing the reactions involved are as follows:—

$$\underset{\text{Calcium sulphate (permanent hardness)}}{CaSO_4} + \underset{\text{Sodium carbonate}}{Na_2CO_3} \longrightarrow \underset{\text{Calcium carbonate (precipitated)}}{CaCO_3} + \underset{\text{Sodium sulphate}}{Na_2SO_4}$$

$$\underset{\text{Magnesium chloride (permanent hardness)}}{MgCl_2} + \underset{\text{Slaked lime}}{Ca(OH)_2} \longrightarrow \underset{\text{Magnesium hydroxide (precipitated)}}{Mg(OH)_2} + \underset{\text{Calcium chloride (permanent hardness)}}{CaCl_2}$$

The soda ash used with the slaked lime then removes the permanent calcium chloride hardness in a manner similar to the equation given above for permanent calcium hardness.

For both clarification and softening treatments, the required chemical dosages are accurately weighed, using a tared bucket and a spring balance. Various methods of adding the dosage to the tank of water were tried to ensure achieving the most satisfactory results.

As a general rule it was found preferable to completely dissolve the soda ash in sufficient hot water in a bucket, the lime being mixed to a slurry in a second container. This slurry is kept stirred and added slowly to the water, the tank agitators being in operation during this time. The bucket is finally washed out in the tank to ensure adding the full dosage. The soda ash solution is added similarly. The same procedure is followed when using filter alum for clarification.

After thoroughly agitating the water for 10-15 minutes the steam is shut off. A second shorter agitation of 5-10 minutes' duration is given approximately half an hour later.

As treatment is normally carried out in the afternoons, the water is allowed to stand overnight and the clear treated supply is available for reticulation when starting up the factory in the morning.

Although the tanks are situated on ground level, it is necessary to have suitable platforms for operatives to carry out the treatment.

At certain times of the year the water, although softer than during dry spells, contains sufficient hardness to merit softening. In addition, clarification is also required due to the presence of suspended matter. Generally speaking, under these conditions the water is treated on the basis of softening requirements, the precipitate of the hardness mechanically removing suspended matter at the same time, resulting in a clear and softened water.

At times a small additional dosage of a special chemical, sodium aluminate, is used to expedite clarification. In the water this chemical hydrolyses, forming both sodium hydroxide and aluminium hydroxide.

The former assists the softening process, and the latter, acting as a coagulant, helps to remove both the precipitated hardness and the suspended matter present.

Although water treated by any of the processes described invariably contains a small residual hardness, it is perfectly satisfactory for all general factory washing operations. For boiler-feed purposes a degree of further conditioning is achieved by the addition of a special chemical, commercially known as Calgon, to offset the low hardness remaining. The usual quantity added is 8 oz. to 1,000 gallons of feed water. In the boiler the hardness is converted to a soft sludge which is eliminated each time the boiler is blown down.

### Sterilization.

As the bore water comes into direct contact with the processed cream and the butter manufactured, it must comply with an approved bacteriological standard. Chemical hardness has no harmful effect and may even be advantageous. A water free from suspended matter is essential and if no such supply is available clarification is a prior necessity. At Beaudesert it would be quite feasible to use the treated river water, but as the bore water is perfectly clear, this supply was considered more suitable. As a general rule bore waters are much less subject than surface waters to bacteriological contamination, and if a clear supply is available it is sound practice to utilise such a source for actual factory processing.

Commercial sterilization is effected by calculating the required amount of a proprietary hypochlorite to give a definite chlorine concentration when added to the water in a tank. The aim is to produce a water at the churn side showing 0·5 ppm available chlorine. As the water after treatment has to reticulate through pipe-lines to the chilling tank, and from there to the churn, some decrease in the chlorine content results and allowance for this must be made in the treatment given in the primary tank. With care, this chlorine demand can be fairly accurately gauged and after experience the water can be kept at the correct standard at the churn without any difficulty. Normally 3-5 ppm in the treatment tank give a water showing 0·5 ppm when used for washing butter.

After addition of the chemical, agitation is given to the water as for the other treatments practised. The water so treated can be used any time following half an hour after treatment.

Although a water supply of an exacting bacteriological quality is not normally required for general factory washing purposes, some consideration should be given to this in deciding on a suitable supply. At Beaudesert the raw river water is normally of low bacteriological quality, but after treatment upwards of 90% of the bacteria present are either mechanically removed or killed by the induced alkalinity of the water. Thus the treated water is of greatly improved bacteriological quality, but subsequent chlorination would be required if the water were at any time used for butter washing.

## CONTROL OF TREATMENT PROCESSES.

Although a complete laboratory investigation is necessary when initiating treatment, control of the various processes involved is best effected by a system of regular tests at the factory itself. At Beaudesert the following tests are a regular part of the treatment:

(1) After tank filling, a sample of the raw river water is tested for total hardness. On this figure a decision is made as to whether the treatment given is to involve softening, clarification, or both. As a rule over 100 ppm would indicate softening, with clarification also naturally resulting; under this figure clarification alone is commonly sufficient.

(2) After overnight settling, a sample of the water is tested for hardness to evaluate the result, and this test is sometimes carried out even for clarification treatment. In the event of an unsatisfactory residual water hardness, some corrective measures are called for and these are practised forthwith.

(3) The bore water supply for butter washing is regularly tested for residual chlorine content as available at the churn. Any variation from the standard prescribed indicates the need for an adjustment of the quantity of chlorine carrier added to the raw water in the treatment tanks.

The methods used for carrying out these tests at the factory are as follows:—

### Quick Estimation of Hardness of Waters.

*Apparatus*:

25 cc. burette; 200 cc. stoppered bottle; clean rain water; standardised soap solution; 100 cc. measuring cylinder.

*Method*:

Into the clean 200 cc. bottle measure 100 cc. of the water to be tested. In the case of hard waters, lesser quantities will be necessary, but the volume must be made up to 100 cc., using clean rain water (that is if 20 cc. of water are taken, 80 cc. of rain water also have to be added.)

Fill the burette with soap solution and adjust to zero, making sure there are no air bubbles in the burette, especially below the tap. Add the soap solution from the burette to the bottle of water, running in 1 cc. at a time until after shaking a lather is formed which persists for 5 minutes when the bottle is laid on its side. When the lather begins to form, the soap solution can be added in smaller quantities, until the requisite permanency is obtained.

*Calculation of Hardness from Graph*:

Hardness may be calculated from the graph of Fig. 1.

Suppose the quantity of soap solution required was 3·5 cc., represented by the point A on the graph. A vertical line through A meets the curve at point B and a horizontal line through B meets the left side at C and this represents the hardness of the water provided 100 cc. were taken for the test. In the case of harder waters, when a smaller sample is taken, the reading C (125 ppm hardness) has to be multiplied by a corresponding factor. For example, if 50 cc. are taken the factor is 2 and the reading C is doubled. If 20 cc. are taken the factor is 5 and the reading C is multiplied by 5 to give the hardness of the water. *Do not multiply the quantity of soap solution used by the factor.*

Note.—The soap solution is made up in alcohol and will readily evaporate if left unstoppered. For this reason do not leave the soap solution in the burette any longer than necessary and always keep the bottle of solution well stoppered.

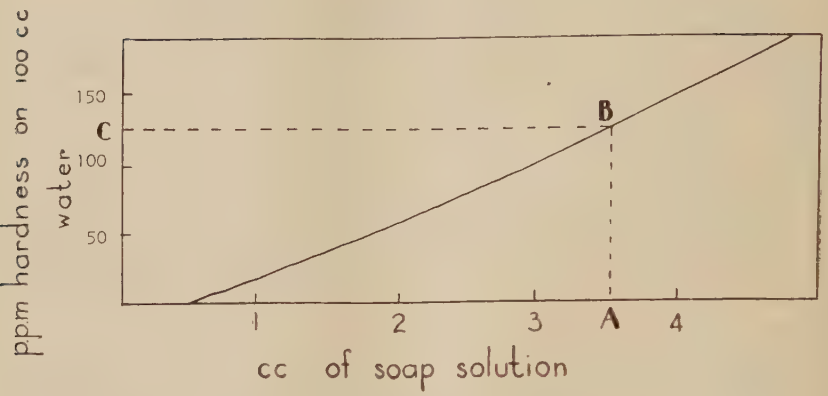



Fig. 1.

**Graph for Calculating Hardness.**

## TEST FOR FREE CHLORINE IN WATER.

*Reagent*:

Orthotolidine solution.

*Apparatus*:

(1) 0·5 ml. pipette

(2) 50 ml. test bottle

(3) set of colour standards representing 0·1, 0·3, 0·5 and 1 ppm.

*Procedure*:

Fill the test bottle to the 50 ml. mark.

If the temperature of the water is less than 70°F., warm to this temperature quickly by immersing in warm water. *Do not heat above* 100°*F.*

Add 0·5 ml. of the orthotolidine reagent, mix, place in a dark place for *not less than* 5 *minutes nor more than* 15 *minutes.*

Compare with colour standards.

NOTES.—If green or blue colours are obtained, add 1 ml. of the orthotolidine reagent to 50 ml. of water instead of 0·5 ml. as directed above.

At no time should the test or the orthotolidine reagent be exposed to sunlight.

The test should be made 30 minutes after the water has been chlorinated. A residual chlorine of between 0·1 and 0·5 ppm. is generally sufficient to ensure a practically sterile water.

When not in use both the reagent and the colour standards should be kept in a cool dark cupboard.

Colour standards should be discarded after six months and a new set obtained.

In the case of Queensland dairy factories, it has been decided that the soap solution be prepared and standardised by the Dairy Research Laboratory of the Department of Agriculture and Stock, the cost of the necessary chemicals being borne by the factory concerned. The set of colour standards required for the second test described above is supplied by the Department at no cost to the factories, with replacements every 6 months.

## INTERPRETATION OF TESTS.

Using the batch lime-soda method of softening as described, it is considered quite satisfactory if a treated water not exceeding 50 ppm. hardness results. Variations can be expected throughout the year, warmer weather conditions tending to give lower residual hardnesses. At Beaudesert a final hardness of 40 ppm. is common, with results not infrequently down to half this figure.

## ECONOMICS OF TREATMENT.

At Beaudesert a careful estimate has been made of the costs of treatment and the savings effected. Before the initiation of water treatment at this factory, costs were found to be excessive, particularly in regard to replacement of equipment, boiler fuel consumption, and detergent requirements.

Previously it was found necessary to replace practically the entire pipe-line system throughout the factory every two years. The expenditure for this amounted to approximately £800, without allowing for the labour involved. Since treatment was commenced in May 1952, it has been unnecessary to replace any pipe-lines.

Other factory equipment badly affected by the hard water included the can washer, the steel stairways and stands, and certain vats. Mild steel, of which this equipment is largely composed, was severely attacked by the corrosive water, replacements in steel costing approximately £100 per annum.

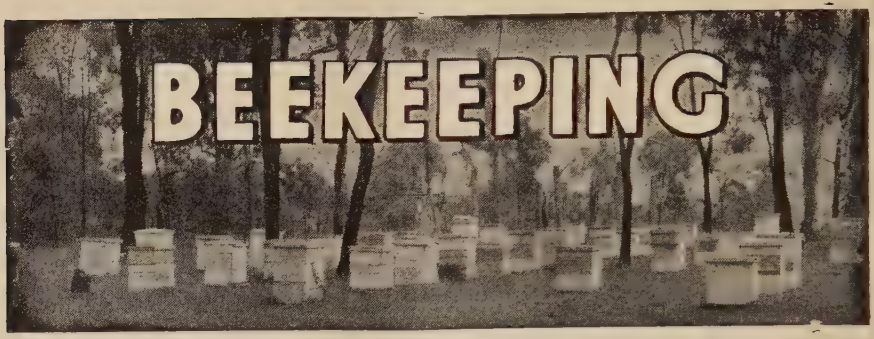
It was difficult to assess the exact boiler maintenance costs attributable to the unsatisfactory feed-water supply. Previously it was necessary to open up the boiler twice a year, descale, examine and replace any faulty tubes or fittings. The wages for this work absorbed £30 per annum, any boiler replacements being additional to this cost. Boiler maintenance is now negligible.

It has not been possible to estimate the saving in fuel consumption, although this is the direction in which the greatest economy in the boilerhouse has been effected. Based on the usual scale deposits found when descaling, the loss in boiler efficiency was computed at between 25% and 50%. Official boiler inspections since water treatment commenced have shown an absence of scaling and only a minimum of non-injurious deposit.

Although the scope of manufacture at this factory has increased considerably in the last three years and now includes a skim-milk drying plant and more intensive methods of cream processing, the detergent requirements have not increased appreciably. In addition, all factory cleaning operations are carried out much more efficiently and expeditiously.

Accurate records have been kept of the cost of chemicals used for water softening. Over a 12 months' period, £140 was spent in this way, although this figure could be expected to vary somewhat from year to year. The total maintenance costs for replacing equipment, descaling and detergent treatment would be above £1,000 per year and it could reasonably be claimed that something in the order of £1,000 per annum is now being saved. Installation costs were relatively small and one year's savings was more than sufficient to offset this outlay.

Although the initial planning and the solving of technical problems have been the responsibility of the writers, the installation of the plant and its efficient operation have only been possible through the keenness and co-operation of the manager, engineer, and factory staff involved. Our sincere thinks are due to all concerned at the factory both for their enthusiasm in carefully attending to all the necessary details of treatment and for their assistance in compiling the data from which the economics of treatment have been evaluated.




# The Honey-Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

(*Continued from page 332 of the December issue.*)

## Gum-topped Box.

*Botanical Name.*—*Eucalyptus hemiphloia* F. Muell. ex Benth.

*Other Common Names.*—Grey box, grey iron-box, brown box, white box.

*Distinguishing Features.*—A tree with grey scaly "box" bark on the trunk and smooth white to greyish bark on the upper part which is shed in long strips that hang down from the top of the rough bark. The crown is usually gradually narrowed to the trunk, with hanging green relatively broad leaves, and the narrow pointed buds and somewhat cylindrical seed-capsules taper to their stalks (Plates 140-142).

*Description.*—This is a tree up to 50 ft. high with rough scaly grey to dark grey bark on the trunk or greater part of the trunk, and with smooth white to grey bark on the upper part of the tree. This smooth bark is shed each year in long strips that remain hanging from the top of the rough bark to give an untidy appearance to the trunk. The main branches are often nearly upright, so that the crown becomes broader towards the top. The leaves hang down from the twigs; they are dark green on both sides, somewhat shining, narrowed to each end, about 3-6 in. long, $\frac{3}{4}$-$1\frac{1}{2}$ in. wide, mostly 3-5 times as long as wide; sucker-leaves are larger, very broad and more rounded. The flowers are white, borne in bunches at or near the ends of the branches, about $\frac{3}{8}$ in. wide when fully out. The buds are narrow and taper gradually to their stalks; the lid is pointed, shorter than the rest of the bud. The seed-capsules are shaped nearly like a narrow cask, about $\frac{3}{8}$ in. long, tapering into a distinct stalk.

*Distribution.*—Gum-topped box is widely distributed in forest country in the Moreton, Wide Bay, and eastern part of the Burnett Districts, often forming pure stands on hard flats. It also occurs in the Port Curtis District, eastern New South Wales, Victoria and South Australia.

In forest country in the Darling Downs District there occurs a "brown box" (Plate 143) sometimes known as *Eucalyptus microcarpa*, but it is not yet known whether it is really distinct from gum-topped box.

*Usual Flowering Time.*—February–April.

*Colour of Honey.*—Medium amber.

*Importance as Source of Honey.*—Medium.

*Importance as Source of Pollen.*—Nil.

*General Remarks.*—This eucalypt usually provides appreciable quantities of beefood even in seasons when an extractable surplus is not forthcoming.

The honey has poor density and a fair flavour but may ferment unless well ripened before extraction. It candies rapidly with a greyish appearance and often darkens during storage.

Colonies working this species often dwindle.

*Note.*—The honey and pollen producing characteristics of the tree in the Darling Downs District referred to as "brown box" are as follows:—

*Usual Flowering Time.*—February.

*Colour of Honey.*—Light amber.

*Importance as Source of Honey.*—Major.

*Importance as Source of Pollen.*—Minor.

Plate 140.

**Gum-topped Box (Eucalyptus hemiphloia).** Leaves, flower-buds and seed-capsules.

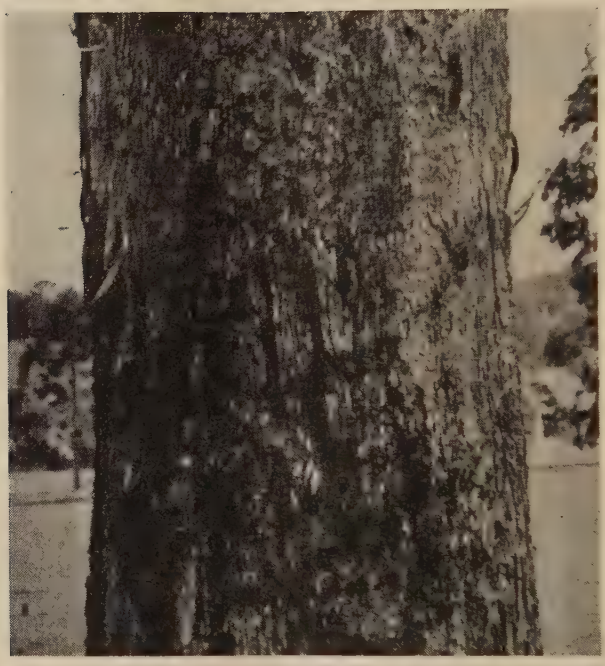


Plate 141.
**Gum-topped Box (Eucalyptus hemiphloia).** Portion of trunk.

*General Remarks.*—Brown box honey is first grade when the nectar flow is rapid and heavy. During good seasons up to 80 lb. may be obtained by a colony within a few weeks.

This reasonably dense honey has a pleasant flavour and granulates either slowly with a coarse grey grain or quickly with a smooth grey grain. It should be packed in new containers, as a dark streaky discolouration may develop if the tins are faulty.

Colonies may lose strength when working this species, as the pollen supply is insufficient for normal brood-rearing requirements.

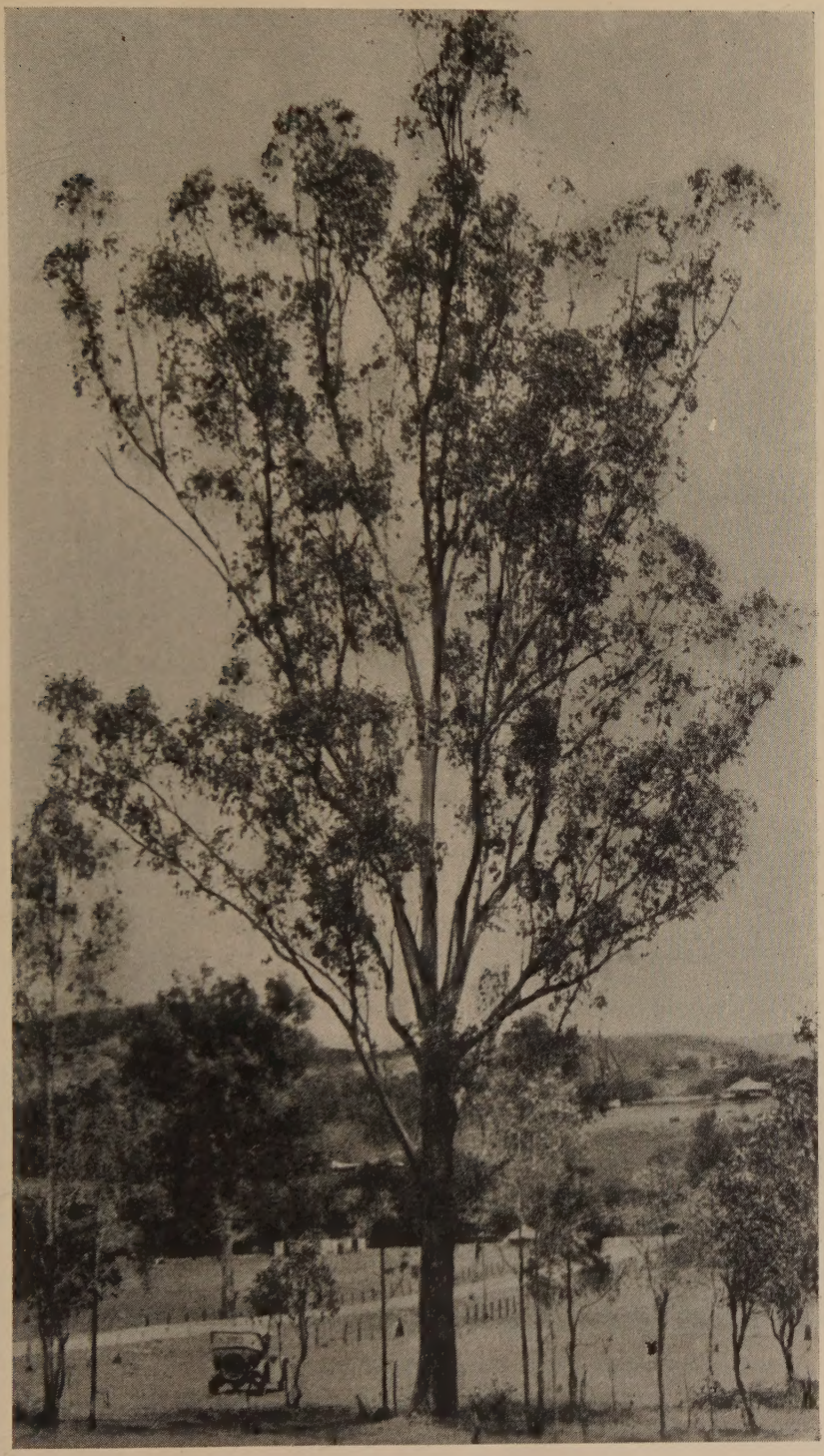


Plate 142.

**Gum-topped Box (Eucalyptus hemiphloia).** Brookfield.

Plate 143.

**Brown Box (Eucalyptus hemiphloia).** Oman-ama.

## Forest Boronia.

*Botanical Name.*—*Boronia rosmarinifolia* A. Cunn. ex Hueg.

*Other Common Name.*—Boronia.

*Distinguishing Features.*—A shrub with stiff narrow leaves, whitish underneath, arranged in pairs along the twigs, and pink to nearly white flowers close to the leaves with four petals and eight small stamens (Plate 144).

*Description.*—This is a somewhat loosely branched shrub usually 2-4 ft. high. The leaves are arranged in pairs along the twigs, and spread widely. They are stiff, whitish underneath, quite narrow, with blunt tips, about ½-1 in. long and 1/16-⅛ in. wide. They are pink or nearly white, about ⅜ in. wide, with short stalks, four small triangular sepals, four nearly triangular petals, eight short stamens and four small ovaries close together in the centre.

*Distribution.*—Forest boronia is found scattered through forest country on sandy or stony soils, chiefly in coastal districts, more rarely in the Burnett and Darling Downs Districts.

*Usual Flowering Time.*—July–September.

*Colour of Honey.*—Medium amber.

*Importance as Source of Honey.*—Minor.

*Importance as Source of Pollen.*—Major.

*General Remarks.*—Forest boronia is a dependable source of pollen which is gathered eagerly by bees. In coastal districts the peak of the annual flowering is during spring and this assists in strengthening colonies early in the season.

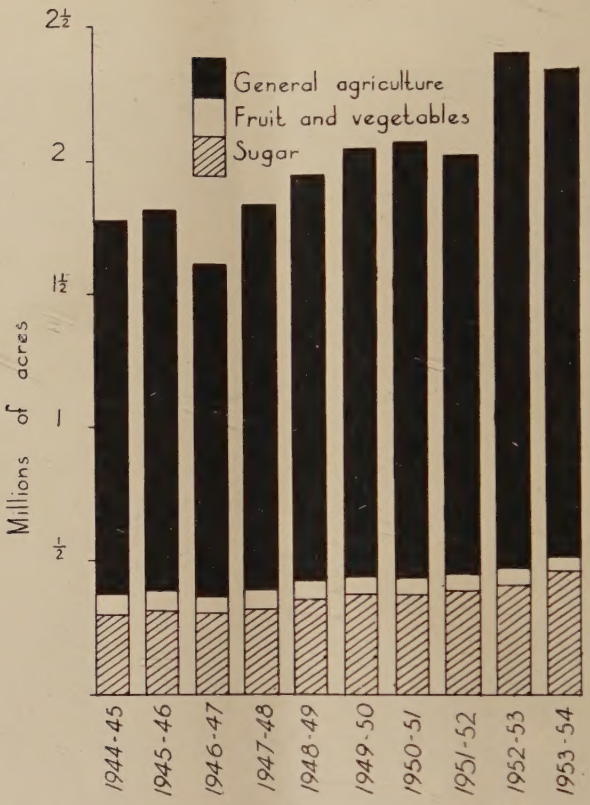
The nectar is useful only as beefood.

Plate 144.

**Forest Boronia (Boronia rosmarinifolia).** Branchlets, showing leaves and flowers.

[TO BE CONTINUED].

**Ten Years of Agricultural Expansion.**




ACRES UNDER CULTIVATION.

| Year. | Sugar. | Fruit and Vegetables. | General Agriculture. | Total Acreage. |
|---|---|---|---|---|
| 1944–45 .. .. .. | 312,176 | 72,809 | 1,411,848 | 1,796,833 |
| 1945–46 .. .. .. | 321,800 | 69,094 | 1,431,214 | 1,822,108 |
| 1946–47 .. .. .. | 308,186 | 64,528 | 1,244,566 | 1,617,280 |
| 1947–48 .. .. .. | 328,486 | 66,980 | 1,453,073 | 1,848,539 |
| 1948–49 .. .. .. | 366,042 | 64,199 | 1,522,254 | 1,952,495 |
| 1949–50 .. .. .. | 381,329 | 61,887 | 1,613,702 | 2,056,918 |
| 1950–51 .. .. .. | 381,545 | 61,547 | 1,633,918 | 2,077,010 |
| 1951–52 .. .. .. | 388,348 | 61,243 | 1,571,610 | 2,021,201 |
| 1952–53 .. .. .. | 419,834 | 65,345 | 1,934,261 | 2,419,440 |
| 1953–54 .. .. .. | 466,478 | 65,024 | 1,826,625 | 2,358,127 |